OFGEM: RESEARCH INTO VOLUME AND INPUT PRICE UNCERTAINTY FOR ELECTRICITY DISTRIBUTION PRICE CONTROL REVIEW 5

April 2009

Final Report

ORIGINAL

Submitted by:

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CEPA

EXECUTIVE SUMMARY AND CONCLUSIONS

This draft final report sets out our analysis of input price inflation (Workstream 1), factors affecting electricity demand (Workstream 2) and the potential need for a mechanism to address uncertainty associated with input price inflation (Workstream 3). As part of our analysis we have reviewed reports prepared by First Economics, NERA and Oxera for the DNOs and specifically EDF[1] and (Western Power Distribution) WPD on aspects of these issues.

Approach (Workstreams 1 and 2)

It is a particularly challenging time to make forecasts of input price inflation (nominal and real) and factors affecting electricity demand. The future paths of the UK and world economies are particularly uncertain because it is unclear when recovery from the recession will start, and what the new trend level of macroeconomic performance will be once the recovery has taken effect. The changes in the macroeconomic environment have been further compounded for the purposes of forecasting input price inflation by the volatility in the prices of materials that are a key input to the expenditure of DNOs. The macroeconomic environment also means that whereas previously inflation could be assumed to be positive, this is not necessarily the case in the shorter term, which may mean that real input price inflation could be quite high in scenarios where nominal input price inflation remains positive during periods of deflation.

These uncertainties have meant that we have been unable to accept directly any of the forecasts provided in the reports of the other consultants, whatever our views regarding their approaches. This is because we could not be confident that the implicit or explicit assumptions about the future macroeconomic conditions that underpinned their forecasts were appropriate. We were also concerned that single point estimates for input price inflation and factors affecting electricity demand failed to reflect the large uncertainty affecting forecasts.

Therefore, we have developed three scenarios of future macroeconomic conditions around which we have then developed forecasts. The scenarios are entitled: "Optimistic Case", "Prolonged Crisis" and "Deflation Trap", and broadly correspond to V, U and L-shaped recessions. The scenarios have been developed from reviewing experience from previous recessions. In very simplified terms, the three scenarios might be described as follows:

- **Scenario 1, Optimistic Case** – In this scenario, a sharp fall in GDP during 2008/9 is followed by a swift recovery and a peak in growth during 2011/12. The economy settles around its trend growth rate of the boom years 1998-2007 (2.8% per annum) and economic activity is high throughout DPCR5.
- **Scenario 2, Prolonged Crisis** – In this scenario the UK economy contracts from 2008/9 to 2010/11. The recovery in 2011/12 is sharp, but the economy

[1] EDF is the trading name in the UK for subsidiaries of Electricite de France.

settles into a lower trend growth rate (2.2% per annum) due primarily to increased regulation of financial services, and also to a sharp decline in public expenditure necessary to restore balance to the public finances.

- **Scenario 3, Deflation Trap** – In this case GDP contracts for three successive years and the rate of recovery is much slower than in either of the two alternative scenarios. As the UK economy struggles to adjust to a new economic environment in which financial services are no longer its main source of value-added creation, it settles to a trend growth rate that is half the rate observed during the boom years (that is, 1.4% per annum).

To forecast input price inflation we would ideally have liked to have considered the relationships between indices for which we can collect historical data and the historical path of such costs for DNOs. This has not been possible because of the limited historical information available regarding the path of the latter. Therefore we have considered the correlation coefficient between potentially relevant indices[2] and RPI, together with a small number of other potential options as a basis for forecasting. Our forecasts use the indices with the highest correlation coefficients with the respective input used by the stylised DNO, but we have also used judgement to select the indices which most closely fit with the activities carried out by the DNOs. We have not, however, always relied solely on the indices with the best correlation coefficients with RPI inflation, but have instead overlaid this with a degree of qualitative judgement using wider evidence.

We explain in detail in Section 6 how we have forecast the factors affecting electricity demand within the context of each scenario. We have sought to draw on historical information about employment levels and connections (residential and industrial) as a basis for developing relationships from which forecasts can be developed. We have then used information and a programme from ONS to convert the projections for Great Britain into projections for each DNO region.

Results (Workstreams 1 and 2)

Table S1 compares our overall results for input price inflation for the three scenarios with the forecasts developed by First Economics. As NERA's forecasts only related to labour and materials' costs a full comparison with their results is not possible. Oxera did not make specific forecasts as a basis for comparison.

[2] Indices that can be considered include those developed by ONS and BERR for employment and materials' costs, together with indices developed by trade associations for more specific labour and equipment costs, which sometimes draw on ONS information.

Table S1: Overall forecast estimates of input price inflation (average % change in real terms over 2010/11 – 2014/15)

	Overall forecast estimates
CEPA Scenario 1	0.9
CEPA Scenario 2	0.6
CEPA Scenario 3	1.8
First Economics (July 2008)	1.4
First Economics (December 2008)	1.3

Sources: First Economics and CEPA analysis

The table shows that our first and second scenarios suggest real input price inflation somewhat below First Economics' forecast, while the results for our third scenario are somewhat above First Economics' results. This last scenario may appear at first glance counter intuitive. However, it is crucial to note that a significant proportion of the DNO's costs is made up by labour costs. While in each of the scenarios we would expect progressively lower nominal wage inflation, historical evidence suggests that wages typically do not fall in nominal terms. Indeed, if prices are falling – as they did in the 1930s - as a result, real wages can actually grow as shown in Scenario 3, and subsequently the DNO's real input price inflation is higher in Scenario 3 than in Scenarios 1 and 2.

However, these high level summaries of the results somewhat mask the differences in the profile of the forecasts. In particular, while the results for our first and second scenario appear quite similar, the profile across the period to 2014/15 is quite different, with the first scenario having a deeper but shorter recession and a general return to trend real input price inflation, whilst the second scenario has a longer recession but by the end of DCPR5, a return to a higher level of real input price inflation due to the assumptions for the economy specified for Scenario 2.

For Workstream 2 we developed forecasts for factors that affect electricity demand – namely employment levels and the number of new residential connections and the growth rate of new industrial and commercial connections. This is in addition to the forecasts for economic growth under the three scenarios discussed above. Our forecasts were made within the context of our three forecasting scenarios and were applied to each DNO's region of activity. Table S2 summarises the results for Great Britain as a whole.[3]

[3] Results for each DNO region are set out in our main report.

Table S2: Great Britain average forecasts for 2010/11 – 2014/15

	GDP growth (% change)	Employment level (thousands)	Residential connections (units)	Industrial connections (% change)	Commercial connections (% change)
Scenario 1	3.0	26,674	187,134	2.6	6.1
Scenario 2	1.9	25,714	167,112	-2.3	-0.1
Scenario 3	0.2	24,941	150,956	-14.5	-13.2

Source: CEPA analysis

Our forecasts show a wide range of potential outcomes for drivers of electricity demand during DPCR5, which highlights the great degree of uncertainty that has been brought about by the economic and financial developments of the past 18 months or so. Not surprisingly, the worsening of the macroeconomic environment is expected to have some negative impact on the drivers of electricity demand, and the worse the crisis is the greater the impact will be. For example, in scenario 1 the UK economy essentially returns to its pre-crisis position, meaning that electricity demand during DPCR4 would correspond to parameters observed during the boom years. In contrast, scenarios 2 and 3 show significantly different outcomes to the previous 10-15 years and highlight the fact that electricity demand during DPCR5 is likely to be strongly affected should the recession carry on beyond the current price control period.

The degree of uncertainty regarding the future macroeconomic conditions makes it very difficult to select any single forecast as the most likely. Ofgem may wish to consider as the price control review progresses whether emerging evidence about macroeconomic developments suggests that a particular scenario is the most likely. At this stage Ofgem could allocate weights to the probability of the three scenarios occurring as follows:

- Scenario 1 - 50%. Scenario 1 fits most closely to the consensus view for the performance of the UK economy over the medium-term.
- Scenario 2 - 35%. Scenario 2 is seen as a real possibility by many economists. Despite RPI inflation recently falling to 0%, CPI currently remains more than 1% above the Bank of England's target. If this situation persists over a significant period of time the Bank will have to increase interest rates potentially creating an outcome for the UK economy similar to the assumptions that guide Scenario 2.
- Scenario 3 - 15%. This scenario is seen as a possibility, but is less likely than either Scenarios 1 and 2. As stated above RPI inflation has already fallen to 0%, and is expected to turn negative in the coming months. It is possible that this will lead to a prolonged period of deflation in the UK economy, though we would expect this to be a less likely outcome for the UK economy.

Workstream 3

When deciding whether to offer additional risk mitigation to the companies it is important to undergo a three stage process:

- Is the cost controllable/predictable/material?
- What form of risk mitigation would be appropriate?
- What detailed design of mechanism is appropriate?

Consideration of the controllability (both price per unit and volume), predictability and materiality suggests that few of the cost items would seem to warrant additional risk mitigation. However, material costs seem to be uncontrollable, unpredictable and material – especially when specific costs of key inputs like copper and steel are considered.

There are several possible approaches to additional risk mitigation including some form of:

- insurance – either through headroom or hedging; or
- indexation/ trigger – which can vary from full cost-pass through to a trigger mechanism that either leads to a re-opener or an automatic adjustment to revenues.

Of the systems it would appear that indexation is likely to impose the lowest transaction cost while providing the protection against uncertainty. We would, however, encourage greater clarity about the "ship-wreck" re-opener[4] that effectively exists since this could capture some of the less material costs and provide greater comfort to the companies.

If an indexation/ trigger mechanism is deployed, as we would recommend, then the detailed design depends on several parameters. The values for these depend in part on the index/indices chosen to be employed and on the degree of incentive that is desired for the company. The report develops examples of mechanisms and illustrates that it is possible to develop a mechanism that can work. We would support any mechanism having a logging-up system incorporated into it since this will still provide protection to the company but not at the expense of increased volatility for customers.

[4] Under the current price control DNOs can seek a disapplication of the price control, which triggers a requirement for Ofgem to either agree a new price control with the DNO or make a reference to the Competition Commission within 18 months. This can be effectively considered to be a means to re-open the price control by the DNO if it is facing severely adverse circumstances.

1. INTRODUCTION

This draft final report for Ofgem covers three Workstreams:

- Input price assumptions for DPCR5 (Workstream 1) – This Workstream required a review of consultancy reports by First Economics, NERA and Oxera[5] relating to different aspects of input prices that some or all of the DNOs were likely to face during DPC5. Following the review and critique of the reports we were asked to develop our own forecasts where we did not propose to use the forecasts in the reports.

- Volume forecasts for DPCR5 (Workstream 2) – This Workstream required a review of consultancy reports by Oxera[6] relating to potential drivers of volume forecasts during DPC5. Ofgem asked for a particular focus on economic growth and the number of new connections (residential and industrial) as potential drivers of future demand.

- Methods to incorporate indexation of real input prices into allowed revenue (Workstream 3) - Building on Ofgem's December 2008 Policy Paper for DPCR5, which raised the possibility of indexation to adjust allowed revenue to reflect changes in input prices, Ofgem asked us to consider how such a mechanism could be designed.

We explain at the beginning of the section of the report covering each Workstream in more detail Ofgem's requirements for the Workstream.

1.1. Approach

The key challenge for this project has been dealing with the significant uncertainties regarding future economic developments that may substantially affect the conclusions reached for all three Workstreams. The future level of input prices will depend on developments in the macroeconomy, as well as specific factors that affect the supply and demand of the inputs. The potential drivers of electricity demand are intrinsically linked to developments in the macroeconomy such as economic growth and housing developments.[7] Finally, the evaluation of a possible mechanism for indexation of input prices to allow adjustments in allowed revenue needs to be informed by consideration of the possible magnitude and direction of input prices in the future.

The uncertainties of the macroeconomy have had a number of practical implications for our work, including:

- **Updated forecasts are required** - While there are aspects of the methodologies adopted by First Economics, NERA and Oxera in their reports that we agree

[5] Full references for these reports are provided in Section 3.

[6] Full references for these reports are provided in Section 5.

[7] As we discuss in later sections there are some very strong correlations between variables such as economic growth and changes in electricity demand.

with, we have not been able to adopt any of their forecasts for input prices or drivers of electricity demand because the implicit or explicit assumptions made in their reports about macroeconomic developments may no longer be appropriate.[8] This does not mean that all of our forecasts for real input price inflation will necessarily be lower than the forecasts of First Economics, NERA or Oxera, but instead as discussed below, they will be underpinned by more specific views about future macroeconomic developments. Therefore, all the forecasts in this report for Workstreams 1 and 2 contain CEPA's views about future input prices and drivers of electricity demand.

- **Scenarios are more realistic than point estimates** - We do not consider it realistic (given the degree of uncertainty) to make a single point estimate of input prices or drivers of electricity demand. Therefore, we have developed three scenarios as regards future developments in the macroeconomy around which we develop estimates of drivers of electricity demand and input prices. While it may be possible to indicate a scenario that is most likely, we recognise that there is a level of uncertainty about future macroeconomic developments that means all the scenarios can be considered as plausible outcomes.
- **Ensuring consistency between the Workstreams** – Although not consistently a feature of the forecasts in the reports we have reviewed, our approach has sought to ensure consistency in the forecasts and approach taken to Workstreams one and two. In particular, where we have developed under Workstream 2 scenarios for the macroeconomy, we have ensured that the forecasts for Workstream 1 are consistent with these scenarios.
- **Forecasts based on long term trends are not reliable** – In more stable macroeconomic conditions it may have been possible to forecast input prices and factors affecting electricity demand based on long term trend values, but given the uncertainty about when and at what level of economic growth the macroeconomy will revert to a trend, this is not credible. We use evidence about relationships between key variables over the long term to make forecasts for input price inflation, but this is different from adopting long term trend values as the forecast.
- **Dangers of spurious accuracy** – Given the degree of uncertainty about the macroeconomy and its impact on input prices there is a particular danger that false comfort could be taken from forecasts of input prices or factors affecting electricity demand at a very granular level or based on a very precise methodology. Therefore, for some input prices we have considered whether relatively high level forecasts may be more robust in aggregate than a combination of detailed forecasts.

[8] For some of the reports it was unclear the precise assumptions being made about future macroeconomic developments, which also made it difficult to fully accept the forecasts.

Had we been undertaking this work a few years ago, it may have appeared reasonable to expect that inflation would have remained positive over the short and long term, based on the inflation target for the Bank of England's Monetary Policy Committee. However, we are now in a period where deflation is a possibility over at least a short period. If nominal input price inflation, particularly wage inflation, is quite sticky, then during a period of deflation, real input price inflation may be quite high. Therefore, while it may appear counter intuitive, during a period of deflation real input price inflation may be higher than during a period of positive inflation.

We explain in more detail in the next section how we have developed the macroeconomic scenarios and our approach to forecasts more generally.

1.2. Structure of the report

The remaining sections of the report are:

- Section 2 explains our overall approach and methodology, particularly for Workstreams 1 and 2.
- Sections 3 and 4 relate to Workstream 1. Section 3 reviews and critiques the consultants' reports for Workstream 1. Section 4 sets out our forecasts for real input prices for each of the scenarios.
- Sections 5 and 6 relate to Workstream 2. Section 5 reviews and critiques the consultants' reports for Workstream 2. Section 6 sets out our views on the implications for the future level of electricity demand.
- Section 7 sets out our approach for Workstream 3, including evaluating whether some form of indexation or trigger is required to deal with input price uncertainty, and if so, what form such a mechanism should take.

Annex 1 sets out the terms of reference for the study.

Annex 2 provides information on the stylised form of a DNO that we have used.

Annex 3 explains our approach to forecasting for Workstream 1.

Annex 4 provides forecasts for Workstream 1 at a more granular level for materials, plant and equipment.

2. Approach and Methodology

2.1. Introduction

As explained in the previous section, CEPA has been engaged by Ofgem to consider various issues associated with the future level of real input prices, impacts on electricity demand and how potential volatility in input prices could be addressed in the setting of allowed revenue. The full terms of reference for our work is set out in Annex 1. This section explains our approach and methodology to address the issues covered by the study. In particular, we consider the macroeconomic context within which we have carried out our study, our approach to forecasting real input price inflation and factors affecting electricity demand, and the GDP and inflation scenarios that we are using in the scenarios we have developed for our forecasts.

2.2. The macroeconomic context

The global economy in general, and the UK economy in particular, have been on a sharp downward trend in recent months. The origins of the crisis can be traced back to the summer of 2007 and the "credit crunch" which followed growing concern by financial market players about the financial viability of assets backed by sub-prime mortgages in the US. However, the situation only descended into a full-blown crisis in the wake of a significant shift in financial market sentiment following the US government's decision not to bail out the investment bank Lehman Brothers in September 2008. The subsequent weeks and months have seen unprecedented action by central banks and governments, to lower interest rates, provide short-term liquidity to credit markets, shore up banks' balance sheets and even nationalise or part-nationalise banks in an attempt to mitigate the impact of the financial crisis on the rest of the economy. However, the impact has been felt across nearly all sectors of developed economies and governments have had to step in and offer "bail-out" plans for other key industries, such as the automotive industry in the US and the UK.[9] The consensus view is that such a wide-ranging and deep economic crisis has not been seen for at least a generation and it is only natural that it would have significant consequences for DNOs, both through movements in real input prices and through affecting the size of the market (in terms of electricity demand) in which each DNO operates.

Evidence would suggest that the UK has been worse hit than most other developed countries by the economic downturn, partly due to the financial services industry's prominence and the way this feeds through to the rest of the economy. Expectations have also played a role in the rapid turnaround of the UK economy, with households holding back on current consumption due to their concerns over job security and future income, while businesses have simultaneously cut back on production and staff in anticipation of lower future demand for their products and services. This has led to a pronounced impact on economic activity, with annual growth measured according to

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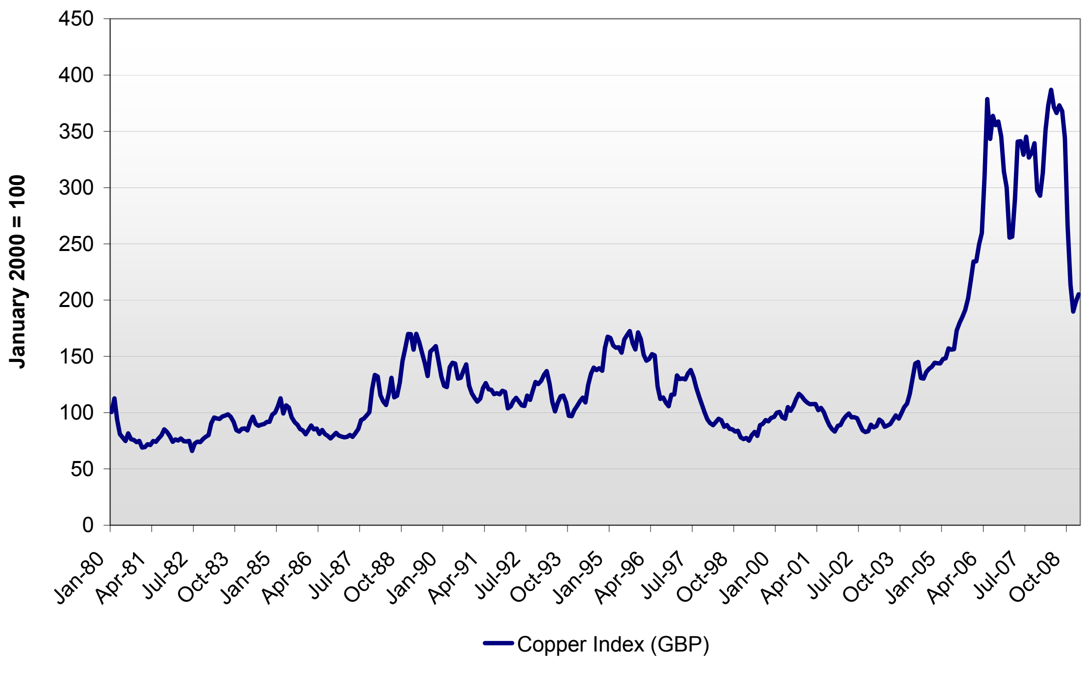
[9] On 27th January 2009, British Business Secretary Peter Mandelson announced a package worth £2.3 billion to support the UK car industry.

Gross Domestic Product (GDP) falling to -1.6% in the fourth quarter of 2008, the lowest figure since the second quarter of 1991 and a sharp reversal from the 2.9% growth recorded in Q4 2007. Furthermore, the economic slowdown has fed into expectations of even lower growth in the period ahead, which naturally feeds through to the demand for inputs – both physical and labour – as well as moderating any price increases (or, indeed, leading to price reductions).

With the rate of economic activity slowing sharply, inflation has also fallen from its highs of the summer of 2008. As of February 2009, the year-on-year rate of the RPI fell to 0.0% – its lowest rate since 1960. In its February 2009 Inflation Report, the Bank of England projected its targeted measure of inflation, the CPI, to be close to zero, and potentially even negative, during the second half of 2009. The Bank also attached a high probability to inflation remaining below its 2% target until 2012.

A key driver of lower inflation has been the price of inputs, which according to the Producer Price Index (PPI) fell by 3.1% in the 12 months to February 2009, compared to a 22.6% increase in the 12 months to February 2008. The observed fall in prices faced by producers has mainly been driven by lower commodity prices, as indicated by the price of copper in Figure 2.1.

Figure 2.1: The traded price of copper



Sources: IMF, Bank of England and CEPA analysis

With companies facing a sharp decline in the demand for their products, payrolls have been slashed – the Labour Force Survey showed that October and November 2008 (the latest months for which figures were available at the time of writing) witnessed the largest increases in redundancies since the series began in 1995, while the often-quoted Claimant Count unemployment level rose to its highest level this decade in January 2009.

2.3. Approach to forecasting

These economic developments have created a highly uncertain environment in which businesses find it difficult to make decisions that have an effect in the short-term, as well as in the long-term. With that in mind, we feel it is important that our approach to making forecasts for both Workstream 1 and Workstream 2 recognises the heightened level of uncertainty that is present. Rather than attempting to make "precise" forecasts based on the current consensus view and/ or market indicators, which in all likelihood will be out of date within a matter of months, we have developed three scenarios that present plausible trajectories for the UK economy over the coming years. We have modelled our forecasts for the key variables in both Workstream 1 and 2 for each of the three scenarios, thus presenting a comprehensive illustration of the real input prices and volumes growth likely to be faced by DNOs if the UK economy were to develop according to each of the scenarios.

Due to the tight deadlines involved in delivering this project, we elected not to develop overly complicated econometric models. Instead our analysis is generally based on simple statistical correlations. Given the uncertainty about future economic developments, there is also a danger that very detailed econometric models provide a false degree of comfort about the precision with which such forecasts can be made (what we term spurious accuracy). As such, our forecasts should not be seen as an attempt to pin down the exact direction of the UK economy in the period to 2014/15, but rather as an attempt at quantifying the impact on DNOs in terms of input prices and electricity demand if the UK economy were to perform in accordance with one of a range of plausible outcomes.

We explain further in Sections 4 and 6 how we forecast real input price inflation and factors affecting electricity demand in the context of each of the macroeconomic scenarios.

2.4. Scenarios for GDP growth

Three scenarios for GDP growth over the period 2008/9-2014/15 form the foundations of our forecasts for input prices and volumes growth and we make all other forecasts with reference to our expected growth figures for the UK under each of the scenarios. Here we provide a brief overview of the three scenarios before discussing in detail our reasoning and comparing our scenarios to current market views.

2.4.1. Overview

As it is already accepted that the UK economy is in recession, the impact on DNOs will stem mainly from the timing and speed of the recovery. As such, this is the element in which our three scenarios differ from each other. In layman terms, the scenarios can be thought of as corresponding to "V-shaped", "U-shaped" and "L-shaped" recessions. We model each of the scenarios based as far as possible on historical evidence – in the first scenario from the UK's domestic experience and in the second and third scenarios from international experience. In very simplified terms, the three scenarios are:

- **Scenario 1, Optimistic Case** – In this scenario, a sharp fall in GDP during 2008/9 is followed by a swift recovery and a peak in growth during 2011/12. The economy settles around its trend growth rate of the boom years 1998-2007 (2.8% per annum) and economic activity is high throughout DPCR5.
- **Scenario 2, Prolonged Crisis** – In this scenario the UK economy contracts from 2008/9 to 2010/11. The recovery in 2011/12 is sharp, but the economy settles into a lower trend growth rate (2.2% per annum) due primarily to increased regulation of financial services, and also to a sharp decline in public expenditure necessary to restore balance to the public finances.
- **Scenario 3, Deflation Trap** – In this case GDP contracts for three successive years and the rate of recovery is much slower than in either of the two alternative scenarios. As the UK economy struggles to adjust to a new economic environment in which financial services are no longer its main source of value-added creation, it settles to a trend growth rate that is half the rate observed during the boom years (i.e. 1.4% per annum).

Quite apart from considering a very wide range of potential outcomes for the UK economy, as is necessitated by the uncertainty in current markets, we feel that one of the strengths of our approach is that it deliberately considers the possibility that within DPCR5 the economy will reach a trend growth rate that is different to the observed long-run historical trend (usually quoted as 2.25-2.5%), thus allowing for the possibility that the crisis would have a long-lasting impact on the performance of the UK economy and, therefore, on DNOs.

The range of scenarios also provides a degree of flexibility for Ofgem as to how it uses our conclusions in reaching conclusions for the price review. While one, or some weighted combination of the scenarios may appear to be the most robust at this stage, developments between now and the final proposals towards the end of 2009 may suggest that a different scenario is more appropriate.

2.4.2. Derivation

In order to come up with our three scenarios we began by examining historical UK GDP data and looked for any common characteristics of past recessions in terms of pace of decline in economic activity, length of time it took to recover, growth rates achieved during the recovery period and the cumulative output gap during the sub-trend growth period. UK GDP growth and its trend rate (calculated using a Hodrick-Prescott filter[10]) are shown in Figure 2.2. We have made the following observations:

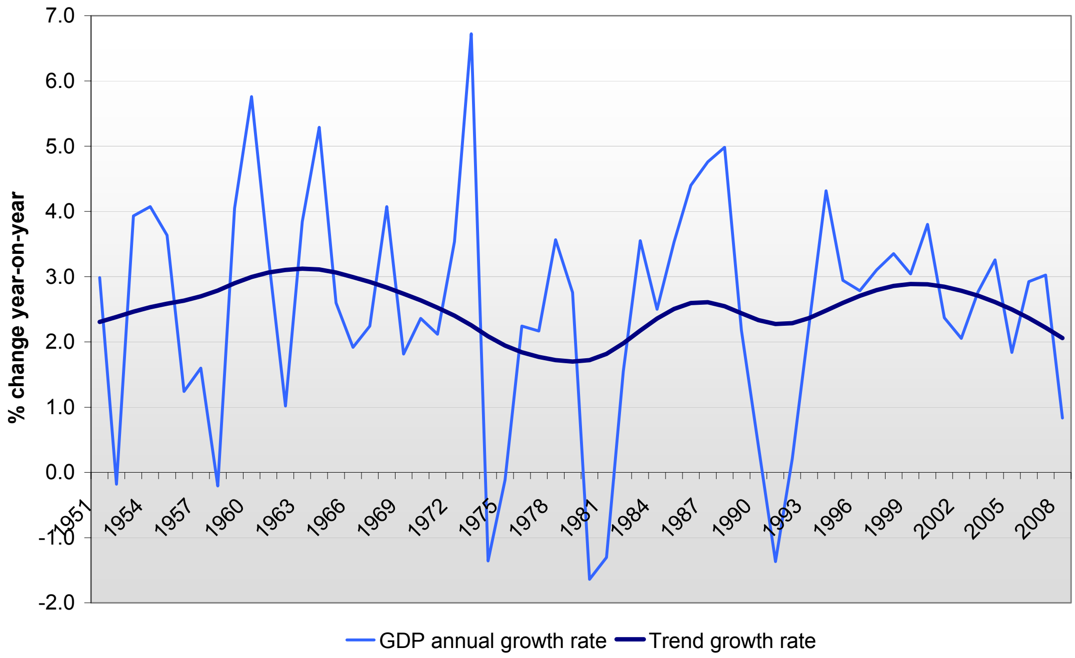
[10] The Hodrick-Prescott (HP) filter was introduced in the discussion paper 'Postwar U.S. Business Cycles: An Empirical Investigation' (1981, published in 1997 in the Journal of Money, Credit, and Banking). It is widely used in economic and financial analysis of time-series data to derive smoothed non-linear trends. An HP trend is calculated by minimising a function of the sum of squared deviations from trend and of movements of the trend line itself, which are multiplied by a smoothing coefficient λ. In accordance with Hodrick and Prescott's recommendation, we set $\lambda=100$ for yearly data and $\lambda=1600$ for quarterly data.

- With the exception of the early-90s recession, the peak in growth was reached 1-2 years after the trough. In the early-90s recession, the peak was reached 3.5 years after the trough.

- The periods following a recovery have tended to be quite volatile in terms of growth, but in general the growth rate has been observed to approach its trend unless hit by another shock.

- The cumulative output gap amassed during a recession has generally been of a similar order of magnitude as the total negative output gap during the period prior to the recession. We note a 6.8% decline in the output gap in the period prior to the current crisis.

Figure 2.2: UK GDP growth and trend growth rate



Sources: The Conference Board and Groningen Growth and Development Centre and CEPA analysis

The above observations formed the basis of our first scenario, which sees five quarters of negative growth during 2008/9 and 2009/10, with GDP growth returning to positive territory in the final quarter of 2009/10 and peaking a year later. This scenario corresponds to an assumption that monetary and fiscal policy measures implemented in the UK and elsewhere are successful in stemming the impact of the crisis and that global economic activity is fuelled by low interest rates and low commodity prices. The UK settles back to its trend growth rate from the decade prior to the crisis "as though nothing happened". The average GDP growth rate during DPCR5 in scenario 1 is 3.0% and the output gap increases by a total of 6.1% during 2008/9-2009/10.

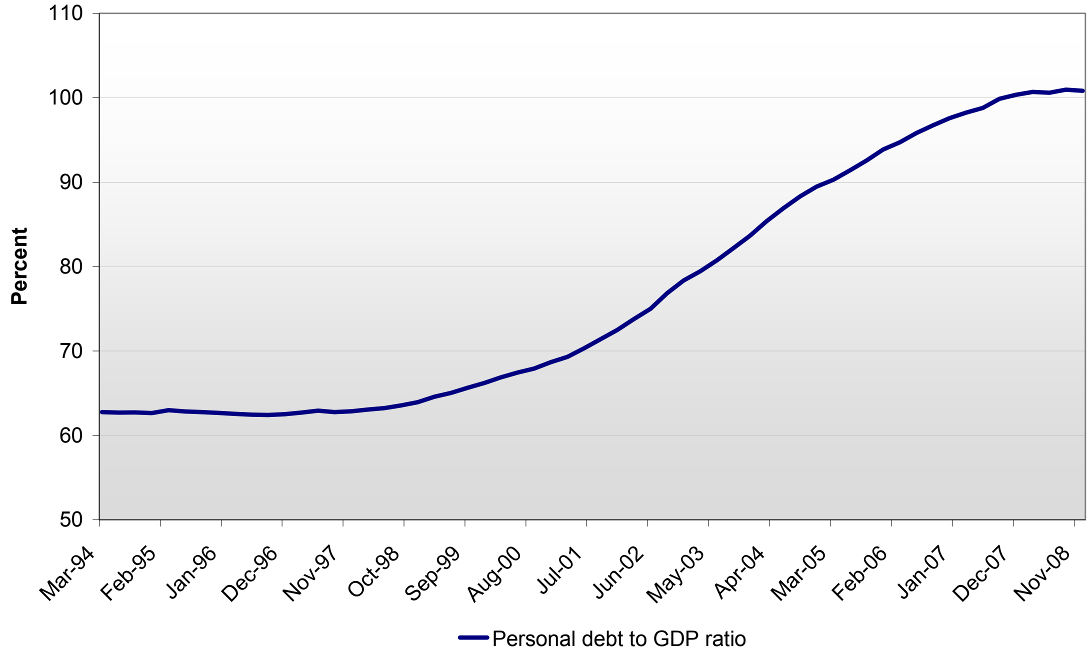
For our second and third scenarios we considered international evidence. In particular, we looked at the two most recent and largest finance sector-driven recessions in developed countries, namely the Swedish banking crisis of the early Nineties and the Japanese "lost decade" of the Nineties and early 2000s. We sought to understand the impact of both of these crises since the conditions that brought them about most closely resemble those that were in place in the UK prior to the current crisis – namely relatively loose regulation of financial markets and institutions, and an expansionary monetary environment, which led to an accumulation of debt by the private sector and resulted in equity and real estate price bubbles.

In Sweden's case[11], a long period of poor economic performance was halted in the second half of the 1980s following the introduction of credit market deregulation in 1985. Monetary and fiscal policies encouraged borrowing and occurred at a time of improving economic performance. Domestic credit markets did not suffer from the same controls that restricted investment in foreign assets, causing bubbles to develop in the domestic equity and real estate markets, fuelled by debt accumulation. With the economy overheating and inflation rising fast, the competitiveness of Swedish exports was hurt. This led to a worsening of an already weak current-account deficit, which generated pressure on the Krona's fixed exchange rate. Interest rates were raised in order to defend the currency against a speculative attack, the impact of which was compounded domestically by changes to the tax regime that raised post-tax interest rates. Overall, real GDP contracted by 6% from 1990 to 1993.

The experience of the UK economy in recent years clearly echoes that of the Swedish economy in the late-80s. For example, in Sweden the ratio of private sector debt to GDP soared from 85% to 135% in the space of five years[12], while the comparable ratio in the UK rose from 64% at the start of 1999 to 100% by the end of 2007 (see Figure 2.3 below). Debt accumulation, among other factors, led to the creation of asset bubbles in the UK equity and housing markets, both of which peaked in October 2007 (see Figure 2.4).

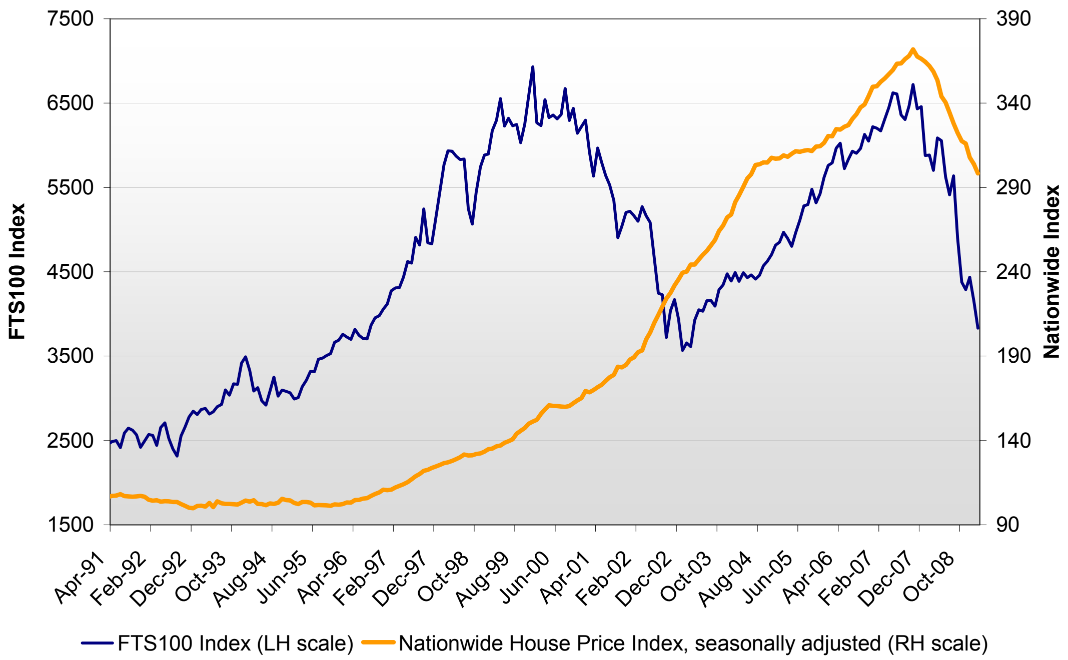
[11] Bäckström, U., 'The Swedish experience', a speech given at the Federal Reserve Symposium, 29th September 1997.
[12] Ibid.

Figure 2.3: Personal debt to GDP ratio in the UK



Sources: ONS, Bank of England and CEPA analysis

Figure 2.4: UK house prices and equity market trends



Sources: Yahoo! Finance and Nationwide

In Sweden's case, the correct policy response led to a sharp rebound in growth following three years of GDP contraction. The Swedish economy then settled in the second half of the 1990s onto a higher trend growth rate than it had been on during the 1970s and early 80s. Taking the Swedish experience and applying it to the UK, we come up with our second scenario. In it the UK economy undergoes nine quarters of negative growth but recovers fast during 2011/12. Subsequently, growth settles to a lower trend than in scenario one, as the government introduces stricter regulation of financial markets in order to mitigate the risk of further asset bubbles forming. By the end of DPCR5, the economy grows by around 2.2% per annum, which corresponds to the average growth rate during 1988-1997 (a period in which the UK economy was first in recession and then underwent sluggish recovery).

Our final scenario is based around the Japanese experience of the 1990s and 2000s, which saw a substantial period of near-zero GDP growth, with the Japanese economy becoming trapped in a deflationary bubble that inhibited any meaningful growth in asset prices. The source of the crisis has been identified as an acceleration in the deregulation of financial markets, coupled with a deepening of capital markets without an equivalent improvement in the regulatory framework.[13] The seeds for the crisis were sown, as in the Swedish case, during the late-1980s with increased deregulation of financial markets, such as the liberalisation of term deposit rates, lifting the prohibition on short-term euro yen loans, removal of restrictions on access to the corporate bonds market, the creation of a commercial paper market, and perhaps most importantly the easing of restrictions on financial institutions that had previously been clearly segregated.[14] This led to Japanese banks taking on riskier assets while at the same time loosening their credit standards. Japanese equity markets began their collapse in the summer of 1990 but the economy failed to recover for several years and the crisis reached its climax during 1997 with the failure of several major financial institutions.

While it is clear that the UK is not yet close to suffering an ordeal similar to Japan's, it is not inconceivable that the policy action taken by the HM Treasury and the Bank of England could deepen the crisis rather than alleviate it. This is particularly a risk with the policy of quantitative easing being employed,[15] as it was this move by the Japanese central bank that is credited with turning a banking crisis into a "decade lost to deflation".

Applying the Japanese experience to the UK in our third scenario, we project three and a half years of negative GDP growth, albeit at no time as deep as the trough of scenario 2. The UK economy then struggles to adjust to the new environment, in which it can no longer rely on its financial institutions in the City to be the main driver of growth. The recovery is, therefore, considerably more sluggish than in either of the first two scenarios, resulting in a trend growth rate by the end of DPCR5 that is around half of the trend growth rate that prevailed prior to the crisis (see Figure 2.5 which depicts Japanese GDP growth over the past three decades).

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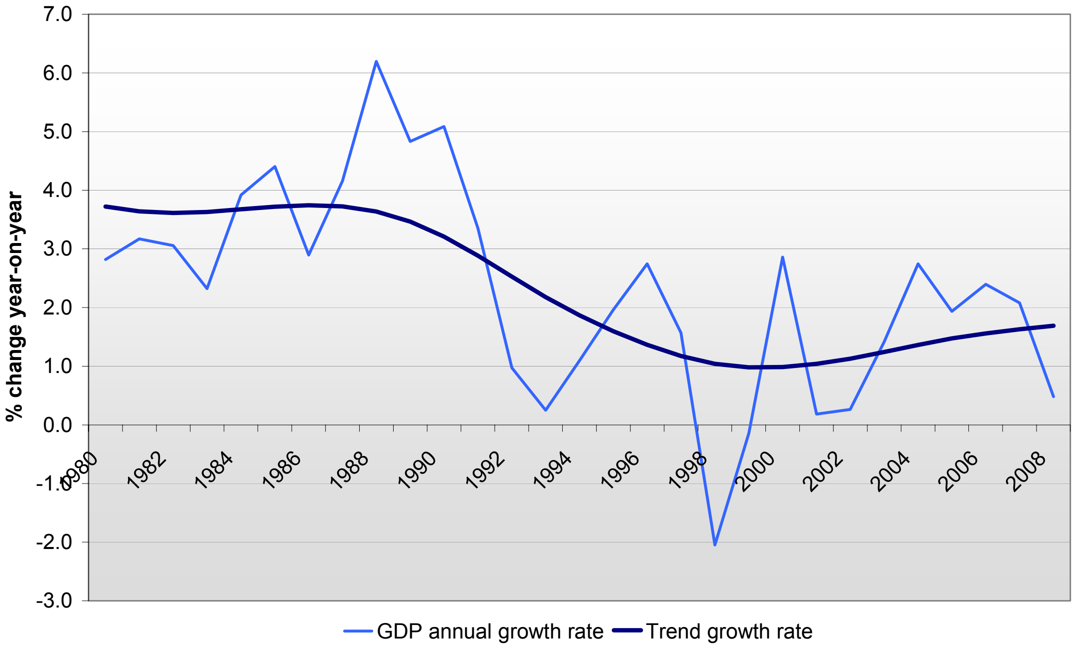
[13] Kanaya, A. & Woo, D., (2000), 'The Japanese banking crisis of the 1990s: sources and lessons', International Monetary Fund working paper number 00/7.

[14] Ibid.

[15] Bank of England 'Bank of England reduces Bank Rate by 0.5 percentage points to 0.5% and announces £75 billion Asset Purchase Programme', news release 5th March 2009.

Figure 2.5: Japan GDP growth and trend growth rate

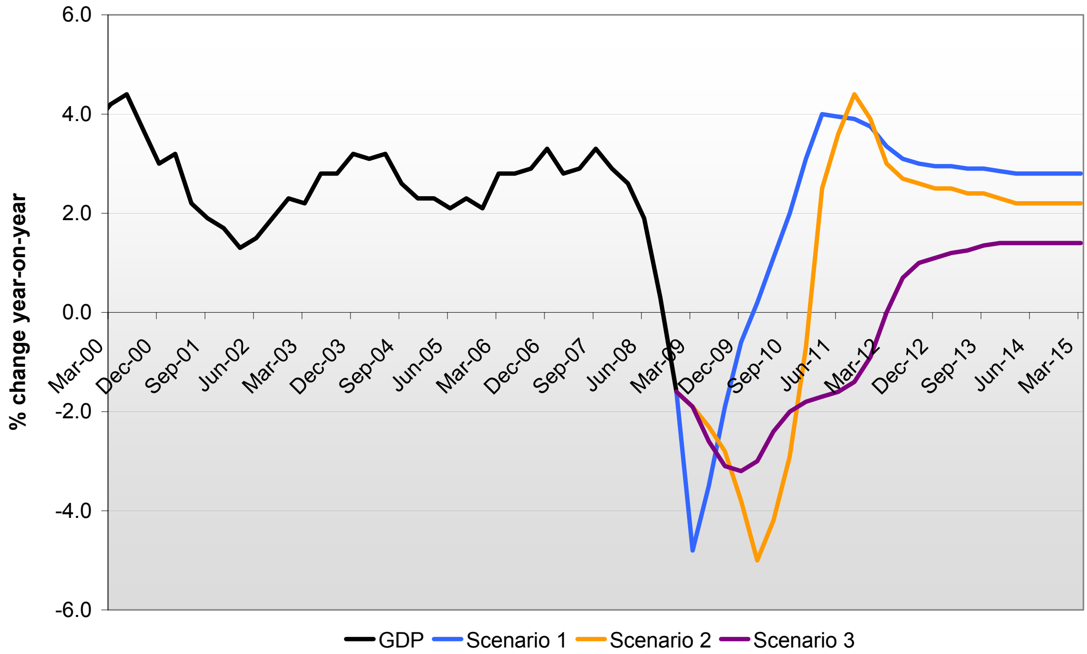


Sources: The Conference Board and Groningen Growth and Development Centre and CEPA analysis

Figure 2.6 illustrates our three scenarios by showing the quarterly year-on-year growth rates of GDP. As the figure shows:

- Scenario 1 can be thought of as a "V-shaped" recession due to the sharp fall and equally sharp recovery in growth;
- Scenario 2 may be thought of as a "U-shaped" recession as both the decline in growth and the recovery are more gradual; and
- Finally, a recession such as indicated by scenario 3 is often considered "L-shaped" due to the long time it takes the economy to recover.

Figure 2.6: GDP growth scenarios



Sources: ONS and CEPA analysis

The implications of our scenarios for growth rates during DPCR5 are shown in Table 2.1. The final two rows in the table show that our three scenarios result in substantially different average growth rates during DPCR5 and for the entire forecasting period. This highlights the level of uncertainty attached to the current economic situation.

Table 2.1: GDP growth forecasts over 2008/09 – 2014/15 (% change year-on-year)

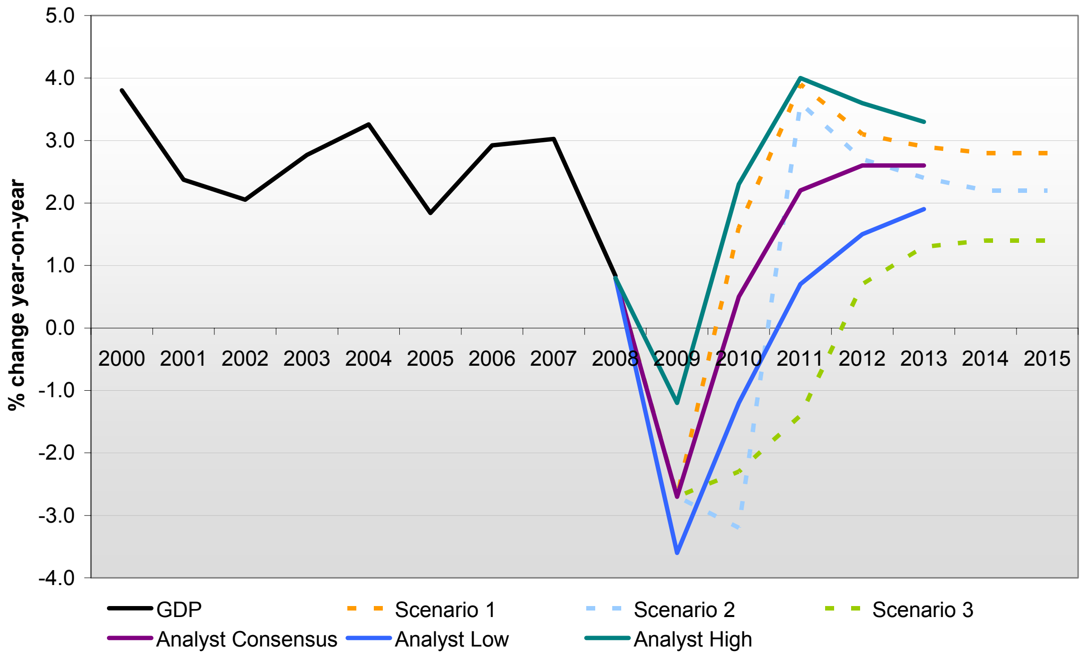
		Scenario 1	**Scenario 2**	**Scenario 3**
2008/9		-3.2	-1.8	-1.8
2009/10		-1.5	-3.5	-3.0
DPCR5	2010/11	2.6	-1.3	-2.0
	2011/12	3.7	3.7	-1.0
	2012/13	3.0	2.6	1.0
	2013/14	2.9	2.3	1.4
	2014/15	2.8	2.2	1.4
	Average	*3.0*	*1.9*	*0.2*
Average for 2008/9-2014/15		*1.5*	*0.6*	*-0.6*

Source: CEPA analysis

2.4.3. Comparison with analyst views

To check the reasonableness of our forecasts, we compare them to the present views of market analysts. It is important to note that we use this comparison only to illustrate how our scenarios compare to the current market view. Since analyst forecasts are made for calendar years rather than financial years, we had to convert our forecasts to calendar years in order to make them comparable. Figure 2.7 compares our growth scenarios to the median, maximum and minimum analyst forecasts from the February 2009 edition of the HM Treasury's 'Forecast for the UK Economy' publication, which collects the latest independent forecast available in each month.

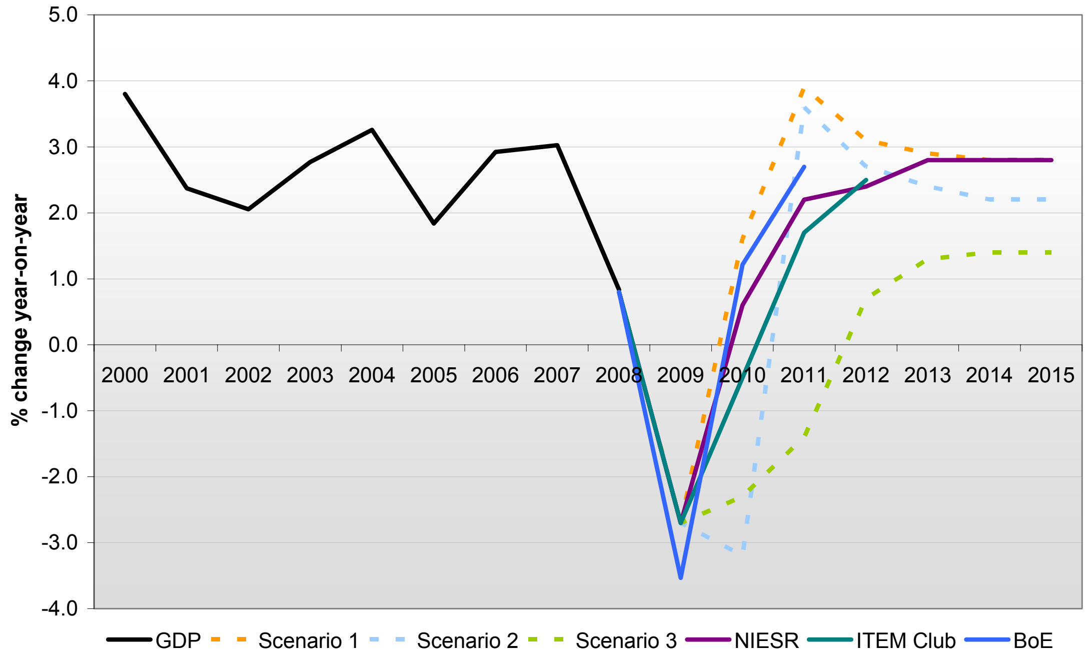
Figure 2.7: Comparison of CEPA scenarios and analyst forecasts



Sources: ONS, HM Treasury and CEPA analysis

Figure 2.8 compares our growth scenarios to the median projection in the Bank of England's February 2009 Inflation Report, as well as to forecasts of two highly-regarded independent bodies – the NIESR and ITEM Club.

Figure 2.8: Comparison of CEPA scenarios and respected institutes' forecasts



Sources: ONS, HM Treasury, NIESR[16] and CEPA analysis

As Figures 2.7 and 2.8 show, our first and second scenarios result in GDP growth paths that resemble in magnitude and direction other forecasters' growth trajectories. Our third scenario is considerably lower than anything that is currently being forecast by the market, although we note that a few months ago no-one was forecasting a deterioration in the economy such as the current consensus view projects.

Finally, we feel that, for the purposes of this study for Ofgem, our scenario approach is more robust than using the consensus view or any specific institute's forecasts due to the following reasons:

- The need to provide point estimates means that analyst forecasts are likely to be a weighted average of a number of scenarios forecasters come up with. Hence, for example, NIESR's average growth projections for 2009-15 are exactly halfway between the average growth rates of our first and second scenarios.
- The scenario driven approach to forecasting that we utilise provides a much more robust framework to carry out forecasts to 2014/15 given the current high level of uncertainty that there is in the economy. According to the HM Treasury's 'Forecasts for the UK Economy', the median growth forecast for the UK economy fell by a total of 2.8 percentage points between October 2008 and February 2009[17] (i.e. equivalent to a average growth rate of the UK economy between 1998 and 2007). This illustrates the risk that relaying on a specific view,

[16] The NIESR provides individual estimates of GDP growth for every year up to and including 2012 and an average growth rate of 2.8% for 2013-217, which we use in Figure 2.8.
[17] HM Treasury, 'Forecasts for the UK Economy: a comparison of independent forecasts', various issues.

however well informed this view might seem at the time, could result in the forecasts being out of date only a short time after they are made.

- An additional benefit to the scenario driven approach is that it enables us to take account of the possibility that the current crisis will lead to a structural change in the economy, causing the economy to end up on a different long-term trend growth rate. As shown in Figure 2.7, the Consensus, Low and High forecasts all essentially point to a convergence on the same 2.5-2.6% growth rate by the end of DPCR5. However, we feel that it is important to consider the possibility that economic growth in the UK will remain different to its trend growth rate, at least over the medium-term, which will have a significant impact on the conditions faced by DNOs.

2.5. Scenarios for RPI inflation

Having set out our growth scenarios, our next step is to outline inflation forecasts that correspond to each of these scenarios. These forecasts will play a central role in Workstream 1 as our input price forecasts are made on the basis of observed correlations between RPI inflation and the growth rate of each input price index.

2.5.1. Overview

Establishing a relationship between inflation and growth based on historical information is difficult. Correlation coefficient statistics, for example, are distorted by the fact that the largest moves in both GDP and the RPI have often been caused by shocks that have the opposite effect on growth and inflation. Furthermore, while weaker economic growth leads to increased spare capacity and, therefore, lower production costs, it also tends to result in a weakening of the domestic currency that, all other things being equal, pushes up the price of imports.

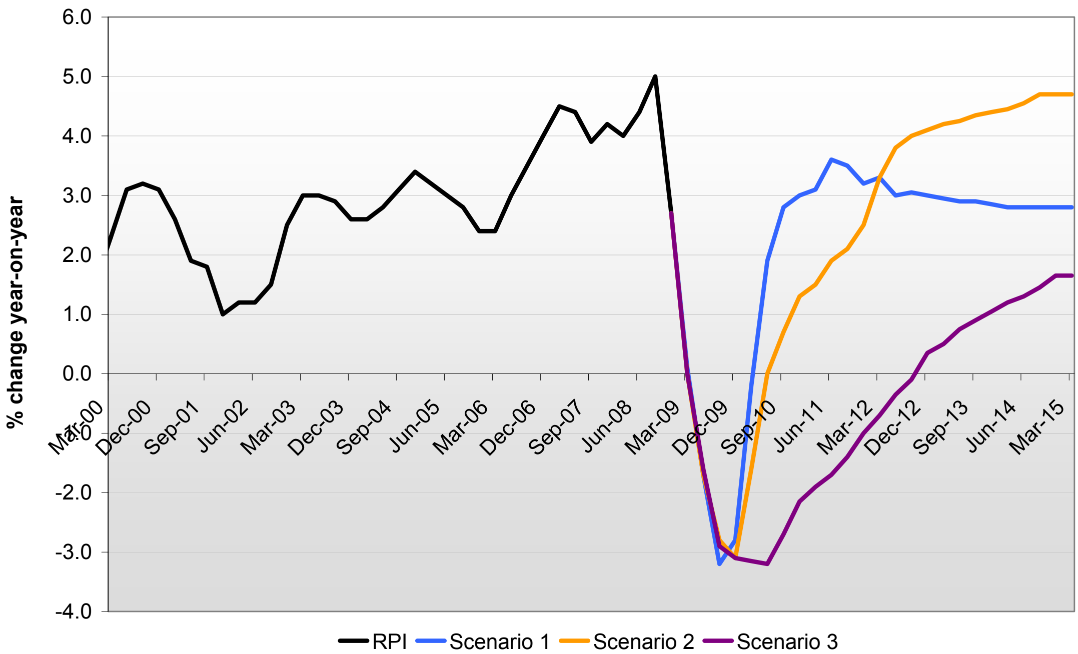
In general, however, it is reasonable to expect inflation to track growth, albeit with some lag. Observing historical data from the UK, we note that inflation has tended to rise almost simultaneously with higher GDP growth, but has tended to lag falls in growth by about one year. The explanation for this is intuitive – businesses are reluctant to lower prices unless a substantial fall in demand occurs and wages tend to be 'sticky', with workers only willing to accept lower wage growth when their jobs are at risk. ONS-published historical wage data shows that workers are also particularly averse to nominal wage cuts – since 1964, average nominal wages for the economy as a whole have not declined in percentage terms. In contrast, both businesses and workers are generally quick to capitalise on higher demand for their products and on increases in the demand for labour, respectively.

Figure 2.9 illustrates the RPI inflation forecasts that correspond to each of our growth scenarios. The forecasts are based on the following rationale:

- **Scenario 1** – Inflation tracks GDP growth with a slight lag, reaching a trough in 2009/10 before rising sharply the following year, after which inflation eases back towards its average rate for 1998-2007 (i.e. 2.8% per year).

- **Scenario 2** – Inflation lags somewhat behind growth, as in scenario 1. It hits the bottom during 2009/10 but takes longer to accelerate as the economy remains in recession during 2010/11. While in scenario 1 inflation eventually subsides, in scenario 2 it continues to rise throughout DPCR5 as stricter regulation of financial markets raises the cost of borrowing, which is reflected in the RPI directly through the mortgage interest payments component. Towards the later years of DPCR5 wage claims respond to the higher costs of meeting mortgage repayments creating a second round driver of inflation.
- **Scenario 3** – After falling for the first couple of years, inflation remains negative between 2009/10 to 2011/12. As the economy recovers very gradually, so does the RPI, albeit at a much slower pace than in either of the other two scenarios.

Figure 2.9: RPI inflation scenarios



Sources: ONS and CEPA analysis

Table 2.2 presents our inflation forecasts for each financial year up to and including 2014/15.

Table 2.2: RPI inflation forecasts over 2008/09 – 2014/15 (% change year-on-year)[18]

		Scenario 1	**Scenario 2**	**Scenario 3**
2008/9		0.0	0.0	0.0
2009/10		-2.0	-2.3	-2.7
DPCR5	2010/11	2.7	0.9	-2.5
	2011/12	3.4	2.5	-1.2
	2012/13	3.0	4.0	0.1
	2013/14	2.9	4.4	1.0
	2014/16	2.8	4.7	1.5
	Average	1.8	*2*	*-0.5*
Average for 2008/9-2014/15		*3.0*	*3.3*	*-0.2*

Source: CEPA analysis

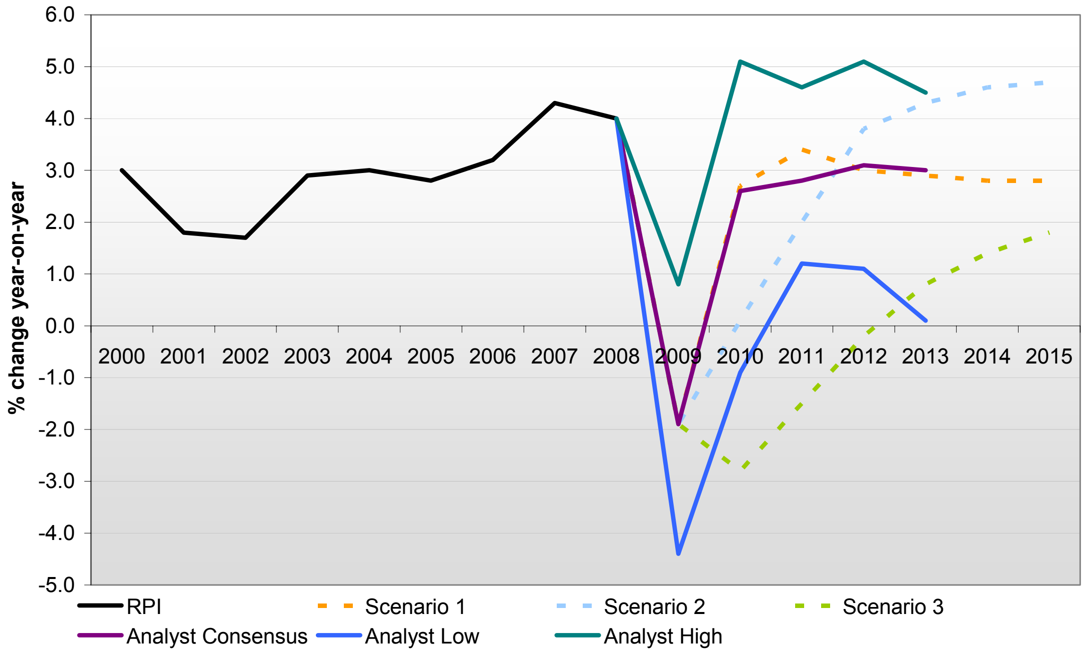
2.5.2. Comparison with analyst views

As with the GDP scenarios, we provide a comparison with current market forecasts for RPI inflation as a sense check on our forecasts. These are presented in Figure 2.10, which compares our scenarios to the median, maximum and minimum analyst forecasts from the February 2009 edition of the HM Treasury's 'Forecast for the UK Economy' publication.[19] We note that our first scenario closely matches the market consensus view. However, the High and Low analyst forecasts substantially differ from our scenarios. The similarity of the trajectory of the three analyst's views suggest that different analysts expect the economic slowdown to affect inflation by different magnitudes, rather than considering alternative ways in which the relationship between growth and inflation will develop over time. Once again, this is another particular strength that we identify in our scenario-based approach to forecasting.

[18] RPI numbers for financial year 2008/09 will be published in April 2009. We have used the year on year RPI % growth figure released in March 2009. See http://www.hm-treasury.gov.uk/d/pdb.xls

[19] Since the official measure of inflation in the UK is the CPI, institutes such as the Bank of England and the NIESR do not provide RPI forecasts for a long enough horizon to be relevant for our purpose.

Figure 2.10: Comparison of CEPA scenarios and analyst forecasts



Sources: ONS, HM Treasury and CEPA analysis

2.6. Summary and conclusions

This section explained our proposed approach to making forecasts for real input price inflation and the factors affecting electricity demand. Rather than forecasting each variable with an implicit assumption of the macroeconomic environment, we have developed three scenarios for the development of the macroeconomy over the period to the end of DPCR5. We then developed RPI inflation scenarios for the three GDP growth scenarios as a basis for the forecasts of input price inflation. As we explain further in subsequent sections, we consider that given the degree of macroeconomic uncertainty this is a reasonable approach to forecasting, rather than focusing on a point estimate of each variable assuming broadly that the economy continues to perform in line with historical trends.

3. Workstream 1 – Review and Critique of the Consultants' Reports

3.1. Introduction

For Workstream 1 we have reviewed the following reports:

- First Economics – "The Rate of Frontier Shift Affecting Electricity DNO Costs, A report prepared for the UK's Electricity DNOs", July 2008.
- First Economics – "Frontier Shift: An Update, Prepared for Western Power Distribution", 22 December 2008.
- NERA – "Real Price Effects: Forecasts for DPCR5, Prepared for EDF Energy", 25 July 2008.
- NERA – "Real Price Effects: Forecasts for DPCR5 Update, Prepared for EDF Energy", 18 December 2008.
- Oxera – "Understanding infrastructure requirements, Impact of regional economic performance, Prepared for EDF Energy Networks", 6 August 2007.

When setting out our review of the reports we have assumed that the readers of our review have access to all of these reports. While we have summarised the main elements and conclusions of each report, and some of the more detailed elements of the reports where relevant, we have not repeated all of the analysis or evidence presented in the reports. In particular we have not explained in detail all of the methods and judgements used by each consultant to reach its conclusions.

After reviewing each of the reports separately we then present an overall comparison of the results. It is important to note that the coverage of the reports is not the same. For example, some of the inputs covered in the reports by First Economics are not covered by NERA and Oxera.[20] Furthermore, the conclusions of the First Economics and NERA reports are much firmer than the conclusions of the Oxera report with regard to specific forecasts. As discussed below, the Oxera report with regard to labour and materials costs is more descriptive of the market trends and movements than attempting to reach firm conclusions about future levels.

In the review of the reports we comment to some degree about the validity of the different indices that are used for or support the forecasts made by the consultants. As part of our methodology for making forecasts in Section 4 we also consider the robustness of the indices used.

3.2. First Economics

We understand that First Economics was asked by all of the DNOs to provide estimates of input price inflation, retail price inflation and potential productivity improvements to

[20] This appears to be a reflection of the different terms of reference for each study.

make an estimate of the cost shift for frontier companies, which the DNOs could use to inform their responses to Business Plan Questionnaire's issued by Ofgem for the EDPCR. First Economics has presented this separately for all the inputs it considers relevant for opex and capex.

As First Economics has updated certain aspects of its July 2008 report in its December 2008 report, for the purposes of our review, where updates have been made, we have focused only on the updates made by First Economics and disregarded the earlier analysis (and conclusions) as it no longer represents First Economics' view. This applies to the input price inflation and retail price inflation assumptions made by First Economics. The need for an update of First Economics' analysis over a relatively short period of time (less than six months) emphasises the volatile and uncertain nature of economic conditions that affect input price inflation.

Ofgem has not asked us to review the analysis First Economics undertook to estimate Total Factor Productivity or other measures of DNO productivity growth. We are also not directly considering analysis of these issues by other regulators, although this can be relevant in some respects, particularly where the evidence may be relevant to assessing input price inflation for DNOs.

To review First Economics' report we first set out its key conclusions, then consider its overall approach and finally review in more detail the individual aspects of its analysis.

3.2.1. Key conclusions

Pages 11 and 12 of First Economics' December 2008 report set out its conclusions about opex and capex input price inflation. For opex this is based on nominal input price inflation of 1.84% in 2009/10, 3.71% in 2010/11 and then 4.12% in each year to 2014/15. For capex nominal input price inflation is 0.68% in 2009/10, 4.58% in 2010/11 and then 4.89% until 2014/15. It has created overall weighted averages using assumptions about the mix of different inputs provided by the DNOs. First Economics use an inflation forecast based on reverting to the target for the Monetary Policy Committee of 2% on a CPI basis (converted to 2.5% on an RPI basis by First Economics) in 2014/15 to forecast real input price inflation. The path to the long term trend includes inflation having a negative value in 2009/10.

The analysis in the July 2008 report had extrapolated input price inflation by using long term forecasts based on historical information. Therefore, the same value was generally assumed for each year.

3.2.2. Overall approach and robustness

First Economics' explain in Annex 2 of its July 2008 report that its approach to forecasting input price inflation has primarily focused around considering evidence on historical measures of the relevant components of input price inflation, and extrapolating these into the future, with some judgement applied to consider whether historical evidence is a reliable guide to the future. This approach is likely to be most reliable where forecasts are either being made for a very long term period and/ or where there is a strong reason to believe that the future will be similar in macroeconomic terms to the past, and for the drivers of individual components of input price inflation. In particular, the approach adopted by First Economics' in its July 2008 report is unlikely to be a robust basis for forecasts of real input inflation where the relationship between nominal and real input prices in the future may be very different from the relationship in the past. For example, First Economics' approach would implicitly assume that in a period of low inflation the nominal input price inflation would be unchanged from the long term trend, thereby leading to high real input price inflation.

As First Economics' December 2008 update report acknowledges explicitly through the approach to updated forecasts involving differences between shorter and longer term views, reliance solely on extrapolating from historical information may not be reliable given current economic conditions. As we discuss further below when reviewing NERA's reports, we are inclined to favour an approach to determine forecasts that considers the historical relationships between indices and RPI that allows our forecasts to recognise the differences between appropriate forecasts for the short and long term. This is not intended to imply a spurious degree of accuracy, as explained below by the use of scenarios. We explain our approach in more detail in Section 4, but our approach explicitly seeks to recognise that a period of low inflation might be accompanied by much lower nominal input price inflation.

First Economics' presents a single estimate for each of the components of input price inflation. Its July 2008 report did not discuss in any detail the degree of confidence or robustness of these estimates. Its December 2008 report recognises that substantial uncertainty over the level of a number of factors affecting input price inflation, including labour and commodity prices given general economic conditions. While we agree that there is very large uncertainty about the level of input price inflation for many of these variables (particularly materials) over the period to 2014/15, we consider that First Economics' report would be more helpful if it included consideration of a range of scenarios and therefore a greater discussion of potential ranges and time periods for trends.[21]

There is no "right" period of time over which long term trends should be estimated for the purpose of forward extrapolation. First Economics' generally use ten years. While this may be reasonable we consider that where possible there would be value in considering whether estimates over a 20 year period would have yielded materially different results.[22] As we discuss below, NERA and Oxera tend to favour a longer time period. This might be particularly important now as the last ten years have been a period of relatively benign macroeconomic conditions, whereas estimates over the last twenty years would encapsulate some previous economic downturns.

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[21] We have not seen the terms of reference for First Economics' analysis, so it may be that it was specifically requested only to produce a single estimate.

[22] As we discuss in the next section it has not always been possible to find sufficient historical information to do this, but in principle we consider that longer time periods than 10 years would be desirable where information is available.

First Economics' December 2008 report appears to have been premised on a view about overall macroeconomic conditions that was broadly consistent with the Government's view at the time of the pre-budget report and corroborated by the Bank of England's view at a similar time. Evidence about actual economic performance since then shows significant variation in for example the level of economic growth. This suggests that First Economics' central case may already be too optimistic about the depth and length of the recession and its impact on input price inflation, although it is too early to say whether its view about the new trend level of growth for the economy will turn out to be correct. Although it is important to note that it is not automatically the case that less optimistic macroeconomic assumptions lead to lower real input price inflation, because it also depends on the effect of the macroeconomic environment on inflation. The substantial deviation from Government forecasts in that period further supports our view that a number of scenarios for general macroeconomic conditions need to be considered, and considerable caution exercised about the robustness of any central forecast.

First Economics' report seeks to verify the conclusions it reaches on a bottom-up basis about frontier shift by considering the conclusions of other regulators, total factor productivity analysis and comparisons between different measures derived from the RPI. Some of this is outside the scope of our analysis, and Ofgem has asked us to make estimates for specific input prices so this reduces the value of comparisons with assumptions made by regulators for overall input price inflation. There is also a question, given the changes in macroeconomic conditions, whether previous precedents are particularly helpful. However, First Economics' review of other sectors highlights that different approaches have been taken, with some regulators preferring a high level approach using an index such as the Construction Output Price Index (COPI), whereas other regulators have adopted a bottom-up approach. Given the particular volatility in recent commodity prices we can see some merit in using higher level indices to forecast materials, and plant and equipment costs.

3.2.3. Mix of inputs for opex and capex

We have not been specifically asked by Ofgem to estimate the mix of inputs for a "typical" DNO or to consider the specific mix for each DNO. We understand that Ofgem will use the estimates for each component and convert them into overall input price inflation estimates. However, as we explain in the next section to aid our analysis and a comparison with First Economics' conclusions, we have developed a stylised DNO based on information provided by Ofgem. It is important to note that our estimate of a stylised DNO has been developed using information from Ofgem, but has not been specifically verified with the DNOs or Ofgem.

3.2.4. Wage inflation

First Economics use Office of National Statistics (ONS), the British Electrotechnical and Allied Manufacturers Association (BEAMA) and the Department of Business, Enterprise and Regulatory Reform's (BERR)[23] analysis of historical wage inflation to estimate future wage inflation in its July 2008 report. Broadly First Economics argue that labour market conditions will remain similar in the future so the longer term trend level of nominal input price inflation is an appropriate estimate for the future. First Economics also notes that major construction projects such as Crossrail and the Olympic games may put pressure on the wage levels of electrical engineers. In its December 2008 report, First Economics acknowledge that the major changes in the macroeconomic conditions are likely to imply reduced wage pressures because unemployment will loosen the labour market. However, this may be partly counter-balanced due to increases in infrastructure spending as a result of the fiscal stimulus by the Government.

We agree with First Economics about the changing nature of the labour market given the recession, but we are inclined to consider that First Economics have been overly optimistic about the length and depth of the recession. As our analysis in the next section explains, while we recognise there may be nominal wage stickiness, we consider there will be some downward pressure on real wage inflation as a result of the recession and the loosening of the labour market.

3.2.5. Materials

First Economics use BEAMA's basic electrical materials index, ONS's Producer Prices survey and information about import prices for copper, aluminium and steel, and BERR's indices' for materials costs in the infrastructure and building sectors as a basis for forecasting input price inflation. While these measures appear to have the virtue of being based on what can broadly be described as factory gate prices, the lack of use of forward looking forecasts may reduce the robustness of the results, particularly over the relatively short term. However, as we discuss in the next section the volatility of commodity prices makes forecasts of these components very difficult.

We also agree with First Economics' December 2008 report that recognised the recent steep falls in many commodity prices including copper and steel. We also recognise that some of the fall in commodity prices is offset by the impact of foreign exchange movements. Nevertheless, consistent with our comments about wage inflation, we consider that First Economics' assumptions about the overall macroeconomy appear over optimistic, and hence the forecasts for commodity prices, particularly a return to a nominal longer term trend by 2010/11 may be over optimistic, or at least alternative scenarios need to be considered. Again, as we note below, NERA is more pessimistic based on reviewing information about forward prices.

3.2.6. Plant and equipment

First Economics use ONS's producer input prices index and the plant and vehicle section of BERR's civil engineering resource cost index to estimate plant and equipment

[23] Specifically the series for labour cost inflation amongst workers involved in civil and mechanical engineering projects.

price inflation. The same issue as for materials price inflation regarding the impact of the recession applies to inflation for plant and equipment.

3.2.7. Rents, Insurance, Transport and IT

While all of these items are more minor than wage and materials' inflation for the overall estimate of input price inflation, we still have concerns about aspects of First Economics' approach in addition to the general concern that it is assuming a shorter recession than appears consistent with current macroeconomic trends. Our key concerns are:

- While insurance premia information is inevitably quite company specific when bought by DNOs, we consider that measures other than household premia information may be more robust to reflect the risks and therefore costs that DNOs face. We consider in Annex 4 whether such information is available.
- While a lot of the components of the estimate of motoring costs used by First Economics are likely to be relevant for DNO's motoring costs, we consider that there might be more specific information about commercial vehicle costs. We consider in the next section whether such information is available.

3.2.8. Summary of the review

We recognise that given the fast changing nature of the macroeconomic conditions it is very difficult to make robust forecasts of many of the components of input price inflation (nominal and real). This partly explains why First Economics' forecasts from December 2008 may already appear overly optimistic given the macroeconomic deterioration, or at least it would be appropriate to consider alternative scenarios.

We consider that First Economics' approach of relying primarily on historical information to make an extrapolation about the future is a reasonable approach for longer term forecasts (where the relationship between nominal and real price inflation might be expected to be stable), but on its own is unlikely to be appropriate for the short term given the uncertain macroeconomic conditions, as acknowledged by First Economics' in its December 2008 update report. We have some concerns about the specific indices used, and considering them alongside some of those used by NERA may produce more robust results, as we discuss in Section 4.

The range of indices that First Economics draw on for its analysis indicates that it will be very challenging for Workstream 3 to identify a sufficiently useful index or indices without excessive complexity.

3.3. NERA

NERA was asked by EDF to forecast the real price effects for key elements of the input costs for EDF to inform its responses to Ofgem's Business Plan Questionnaires. NERA's analysis is carried out specifically for EDF. We discuss further below how this might affect its general applicability to other DNOs, but as a minimum consideration would need to be given to whether labour market assumptions for the EDF's networks in the South East would be appropriate to other parts of the country.

While First Economics consider all the inputs, NERA make estimates of the real price effects for only labour (internal and contract) and materials. Although it does not affect the substance of the conclusions or the ability to make comparisons with First Economics, NERA present their conclusions as real price effects, that is, after adjustments for RPI, while First Economics present nominal price movements and explain their RPI assumption.

As with the First Economics reports, NERA has updated a number of its conclusions in a December 2008 report, although it did not make any major methodological changes compared to its July 2008 report. Therefore, while our review of NERA's methodology focuses on the July 2008 report, we consider the merits of the results presented in the December 2008 report. As with First Economics, the material changes in NERA's results over a six month period, indicate the significant uncertainty associated with any forecasts made in the current macroeconomic environment.

3.3.1. Key conclusions

NERA's forecast for the real wage inflation for internal labour was based on the long term growth rate in real earnings in the private sector of the economy, and so it estimated 1.4% annually from 2009. It did not consider this estimate to be sensitive to short term fluctuations in economic conditions so did not update its analysis or forecast between the July and December 2008 reports.

Its conclusions on contract labour real wage inflation used two approaches that drew on Joint Industry Board (JIB) and Building Cost Information Service (BCIS) information and forecasts. Only the BCIS forecasts were updated between the July and December 2008 reports. Based on HM Treasury inflation forecasts, NERA forecasts real wage inflation of 1.93% in 2009, 3.64% in 2010, 3.45% in 2011 and 2.34% in each subsequent year.

NERA's forecasts for the real input price inflation for materials were based on an index of manufactured electrical materials similar to those purchased by EDF and commodity prices. The updated December 2008 forecasts took account of updated forecasts from BCIS, Oxford Economics, Bloomberg and Agoria. NERA noted that forward curves at that time suggested that commodity prices would increase gradually in nominal terms up to 2016, but this would still imply real terms falls in the later years of the forecasting period. For 2009 NERA forecasts real materials input price inflation of 4.1% in 2009, -0.7% in 2010, -0.1% in 2011, 0% in 2012 and -0.1% in subsequent years.

For the purposes of its analysis NERA uses Treasury forecasts of inflation.

3.3.2. Overall approach and robustness

NERA's approach differs quite significantly from First Economics' approach in its July 2008 report, although the approach in First Economics' December 2008 report begins to converge with NERA's approach. Specifically, while First Economics primarily consider evidence about historical input price inflation to make extrapolations about future input price inflation, NERA consider both historical and forward looking information to make its estimates. This difference in approach is most marked for the short to medium term, where NERA places reliance on evidence from forward price curves and forecasts of wage inflation as the basis for its estimates before considering longer term trends for longer term forecasts.

As discussed above, First Economics' approach is likely to be relatively robust for the long term, but appears less suitable in the short term, particularly a short term characterised by the degree of uncertainty currently present in macroeconomic conditions. Therefore, we are inclined to favour the general approach adopted by NERA where longer term trends form the basis for longer term forecasts, but information about the short term is also considered to make short term forecasts. However, as with the First Economics, we would have preferred more of a discussion by NERA on the uncertainties, associated with their forecast. Some consideration of alternative scenarios would have helped to reflect this.

In addition to considering more short term information, NERA also generally rely on a wider range of indices and sources of information to make their estimates than First Economics.[24] In principle the consideration of a wider range of indices should improve the quality of the forecasts, but it can also imply a degree of accuracy in the forecasts that might not be merited.

3.3.3. Internal wage inflation

NERA take as its starting point for considering the real wage inflation of internal labour, evidence about EDF's historical level, which is estimated as 1.3% above RPI over the ten years from 1998 to 2007. It has then sought to consider whether wider evidence about wage settlements suggests that EDF's historical level reflects the position in the wider economy.

For historical information, NERA use data from the ONS regarding average earnings in the whole economy dating back to 1991, by sector dating back to 2000 and the ONS survey on hours and earnings, which includes separate categories for the production and distribution of electricity, and electricity, gas and water supply. NERA also look at information about three BCIS indices that relate to electrical labour, which are Electrical Labour, Electrical Engineering Labour and Labour indices and data from JIB for the electrical contracting industry. It also looks at Labour Force Survey information from ONS that enables consideration of labour for different skill levels. Finally it considers information about electricity industry pay settlements in 2005/6.

NERA considered that the combination of historical evidence suggested that there was no objective evidence to justify a forecast for real wage inflation for internal labour different from long term rates of real earnings growth in the economy, which has been at

[24] Although as noted above, First Economics seek to verify their overall conclusions about frontier cost forecasts with other approaches to making the estimate apart from building it up on a bottom-up basis.

1.42% in the private sector since 1992. It considered an Oxford Economics forecast up to 2011 to verify whether this trend was likely to continue.

We agree with NERA that in nominal terms wages are typically sticky. However, there is evidence from recent private sector earnings data of a nominal fall. We also recognise that even if the current macroeconomic conditions imply that there will be strong pressure to keep nominal wage increases to a minimum there might still be real wage increases if RPI becomes negative or is near zero. The difficulty of forecasting in the longer term is knowing when the economy will improve and the associated trajectory for inflation. We consider further whether there may be evidence to suggest that in the medium term pressure will remain sufficient on nominal wages that would suggest that NERA's forecast was optimistic if inflation reverts close to the target for the Monetary Policy Committee. However, given the stickiness of nominal wages we do not disagree with NERA that a positive number is likely, even if it may be lower than NERA suggest.

Given the stickiness in nominal wages for internal staff, the bigger issue for this price control review for Ofgem may be the balance between internal and contractor labour that is assumed when setting the price control. To the extent that companies have greater scope to benefit from downward pressure on wages through more use of contractor labour then Ofgem might want to factor that into its price control proposals.

3.3.4. Contractor wage inflation

In addition to considering the evidence set out above for internal labour, NERA also considered a range of forward looking information to inform reaching a view about contractor wage inflation. This included BCIS and JIB forecasts. It then uses two methods to forecast real contractor wage growth that seek to capture the different mix of skill levels used by EDF.

Before finalising its estimate for real contractor wage inflation NERA considers whether there is evidence to make a specific adjustment to reflect a potential increase in construction projects, particularly in the South East of England. NERA considers estimates of new construction projects made by Hewes and its own analysis of forecast utility projects, recognising some uncertainty where price control reviews are in progress. It also considers the correlation coefficient between real wage growth and capex projects. On the basis of this analysis NERA uplifts a little its estimates for real contractor wage growth.

We consider that NERA may have under estimated the extent to which EDF could benefit through lower real contractor wage inflation from the downturn in macroeconomic conditions. While contractors may also face quite sticky nominal wages, EDF could benefit from pressure on contractors' profits that would feed through into EDF's costs. There are other factors that may suggest that contractor's wages are relatively flexible, including that they may not be covered by collective bargaining agreements to the same extent as internal staff wages, and it will generally be easier for companies to lay off contractors than internal staff.

We broadly agree with NERA that there appears to be evidence, particularly for the South East of England that there will be increasing pressure in terms of major infrastructure investment. However, some caution needs to be exercised in considering whether there might be some counter-balance to this through downward pressure in other construction projects, including much lower new housing developments and difficulties in financing PFI projects.

3.3.5. Materials

NERA reviewed evidence about the historical trends and forward curves for the commodities that EDF buys, including copper, steel, aluminium, oil and plastics. These had changed most markedly from 2005 to early 2008, and the forward curves in July 2008 suggested a levelling off of prices or a slight fall. By December 2008 forward prices had fallen significantly, although in sterling terms this effect is muted by exchange rate movements. In addition to general market evidence, NERA considered evidence from a range of producer price indices to get a better understanding of the actual prices being paid, and the degree of lag between market prices and factory gate prices. NERA considered information from ONS and BCIS, including the Construction Output Price Index (COPI).

NERA estimated that there was a lag between market prices and factory gate prices of between six and 18 months. The conclusions from the July 2008 report about interpreting trends from historical materials prices have been largely overtaken by movements in actual prices and the forward curve.

To make its forecast NERA constructed a weighted index of commodities prices based on usage by EDF. A range of evidence is then considered including from BCIS, Oxford Economics, Bloomsbury Mineral Economics and Energy Information Administration.

We recognise the genuine difficulties in seeking to forecast materials prices at this time, given the substantial volatility in prices over recent months. We are broadly comfortable with NERA's approach of combining a historical review with forward looking information, although some of the specific relationships may be appropriate for EDF, but not for other DNOs. We consider further below whether NERA's approach of seeking to forecast at a very detailed level risks creating spurious accuracy compared to a higher level forecast, such as COPI, which the CAA has recently used.

3.3.6. Wider applicability to other DNOs

NERA was specifically asked to consider the real price effects for EDF, and has not had particular regard to whether its conclusions would be applicable to other DNOs. For internal and contractor wage rates there will be differences between different regions of the country in nominal terms, although the magnitude of differences in real terms may not be that large.

It is much less clear that there would be significant if any differences in materials costs between different DNOs based on their geographic location. This is particularly the case given that the materials include a number such as steel and copper that are purchased on world markets. There may be differences that reflect DNO's different procurement policies, but this is not directly relevant to consideration of the input price inflation for frontier companies.

3.3.7. Summary of the review

We consider that NERA's general approach of combining an analysis of historical information with information about potential changes in the future is a robust approach to forecasting input price inflation for labour and materials in the current uncertain macroeconomic climate. As with First Economics we are concerned that NERA's analysis did not consider the use of alternative scenarios or discuss in substantial detail the sensitivity of its estimates given the current macroeconomic uncertainty and the recent volatility in commodity prices.

NERA's analysis draws on a very large range of indices compared to First Economics. This can partly be seen as a good thing because more information should in principle lead to better accuracy. However, we consider further in the report whether, particularly given the current uncertain macroeconomic conditions there might be value in using higher level more overarching evidence that avoids the spurious accuracy of more detailed forecasts.

3.4. Oxera

Oxera was commissioned by EDF Energy Networks to undertake a review of the economic outlook across its distribution franchise area for period 1 (now until 2012) and period 2 from 2013 – 2025. The report aims to contribute to EDF's capex planning process. Specifically the paper:

- analyses expected levels of economic growth in the three distribution areas (East of England, South East, and London); and
- then analyses the labour and materials markets, discussing the costs of labour and materials to deliver EDF's future capex requirements.

For the purposes of this section we discuss briefly the work carried out by Oxera to assess EDF's infrastructure delivery costs over periods 1 and 2 (Section 4 of the Oxera report).

It is important to note that both First Economics and NERA were specifically asked to produce input price forecasts, while Oxera were seemingly tasked with producing a more general review of the economic outlook over the long-term capturing potential developments in EDF's cost base. As a result Oxera's report does not contain input price forecasts that are directly comparable to the First Economics and NERA reports. Instead the Oxera report makes more qualitative judgements on EDF's future materials and labour costs. Furthermore Oxera's analysis, particularly of future trends in wage rates, is specific to the particular regions served by EDF limiting the applicability of the analysis to the other DNOs.

It is also important to note that Oxera's paper was written in August 2007, thus while many of the inferences they draw may have been correct given the information available at the time, many of the conclusions need to be reassessed given the impact of recent macroeconomic events. Although Oxera did caveat their conclusions by making clear that a major recession could change the conclusions reached.

As a result of these points we provide a more brief review of the Oxera report, first setting out the main conclusions that it reaches then discussing the overall approach it uses.

3.4.1. Key conclusions

Oxera's overall judgement on the future metals prices faced by EDF is that the price would decline until 2012 as the global supply of metals increases in response to the increase in demand for metals driven by factors such as the development of China. In the longer-term Oxera concluded that metals prices may return to the historic long-term price level, but noted that there may be some upward pressure on metals prices in the future caused by factors such as the increased use of more marginal sources of metals reserves and due to increases in labour costs as incomes continue to rise.

Oxera concluded that the price of electrical materials would most likely remain high over the next few years, before potentially decreasing back towards more historic levels, depending on the extent to which additional supply capacity of electrical materials becomes available in the coming years.

Oxera make no direct judgement on labour wages (neither internal, nor contract labour wages), instead they quote Ofgem's determination in the gas distribution price control review that internal and contract wages will increase by 1% and 2% in real terms respectively; though the paper does not explicitly state if Oxera supports the Ofgem wage projections.

3.4.2. Overall approach and robustness

The approach adopted by Oxera differs from that used by First Economics and NERA, in that they analyze historic price trends to identify (in their view) the main drivers of global/ regional demand and supply for the input, they then take a view of the future trends in demand and supply for the input enabling them to make a conclusion on the future price trends.

The conclusions made by Oxera are qualitative in nature, and note the level of uncertainty involved in making any overall conclusions about input price growth, particularly over the longer-term. Oxera also recognise the need to use scenarios to analyse long-term price trends.

Given the qualitative nature of the conclusions made by Oxera, the approach that they use is generally sound. Perhaps the main criticism of their methodology is that given the significant debate that could be had around the drivers of global demand and supply of metals that Oxera mention, the paper could be more nuanced when making conclusions on the determinants of global/ regional input demand and supply.

As noted above both the analysis and conclusions made in the Oxera report are now outdated given the impact of recent macroeconomic events.

3.5. Comparison of results

As noted above, First Economics, NERA and Oxera do not have the same coverage for their results so full comparability of the results is not possible. Tables 3.1 to 3.3 below compare the results in the reports where comparison is possible. In all the tables we strip out the different RPI assumptions made in the reports to compare real price changes. In making the comparisons we recognise that First Economics' estimate was for all DNOs, while NERA's and Oxera's were only for EDF.

Table 3.1 compares First Economics' forecast of general wage inflation with NERA's forecast of internal wage inflation.

Table 3.1: Internal and general real wage inflation

Year	First Economics (December 2008)	NERA (December 2008)
2008/09	n/a	1.42%
2009/10	4.75%	1.42%
2010/11	1%	1.42%
2011/12	0.25%	1.42%
2012/13	0.75%	1.42%
2013/14	1.25%	1.42%
2014/15	2%	1.42%
2015/16	n/a	1.42%
Average 2009-2014	1.67%	1.42%

Sources: First Economics and NERA

Table 3.1 shows that First Economics' estimate is significantly lower than NERA's for most of the period, but is much higher than NERA's at the beginning of the period and increases above NERA's in the later part of the period. The average for 2009-14 shows that there is a relatively small difference between the two estimates.

Table 3.2 compares First Economics' forecast of specialist wage inflation with NERA's forecast of contractor wage inflation.

Table 3.2: Contractor and specialist real wage inflation

Year	First Economics – Labour Electrical (December 2008)	First Economics – Labour Specialists (December 2008)	NERA (December 2008)
2008/09	n/a	n/a	1.12%
2009/10	6.75%	6.75%	2.93%
2010/11	2.5%	3%	2.83%
2011/12	1%	1.75%	2.28%
2012/13	1.5%	2.25%	2.28%
2013/14	2%	2.75%	2.28%
2014/15	2.5%	3.25%	2.28%
2015/16	n/a	n/a	2.28%
Average 2009-14	2.7%	3.29%	2.29%

Table 3.2 shows again a pattern where First Economics generally has substantially higher estimates than NERA at the beginning and end of the time period, but their estimates fall below NERA's in the middle of the period. First Economics' estimates are higher than NERAs for the period 2009-14.

Table 3.3 compares First Economics' forecast of materials price inflation (opex) with NERA's forecast.

Table 3.3: Materials real inflation

Year	First Economics (December 2008)	NERA (December 2008)
2008/09	n/a	4.1%
2009/10	-7.25%	-0.7%
2010/11	2.5%	-0.2%
2011/12	1%	0%
2012/13	1.5%	-0.1%
2013/14	2%	-0.1%
2014/15	2.5%	-0.1%
2015/16	n/a	-0.1%
Average 2009-2014	0.4%	0.4%

Sources: First Economics and NERA

Table 3.3 shows that First Economics and NERA make very similar forecasts regarding materials real inflation over the whole period, but annual forecasts differ markedly.

4. WORKSTREAM 1 – CEPA'S FORECASTS

4.1. Introduction

This section explains our approach to forecasting real input price inflation for DPCR5, and then goes on to set out forecasts for each of the scenarios in Section 2.

4.2. Approach

As explained in Section 1 and further discussed in Section 3, we did not consider that it was possible to simply accept some or all of First Economics' or NERA's forecasts for real input price inflation because we were not confident that they reflected appropriate assumptions about macroeconomic developments. In particular, First Economics and NERA did not consider different scenarios for future macroeconomic developments, and given the uncertainty about the macroeconomy, we consider that a range of scenarios (as set out in Section 2) need to be considered. It does not automatically follow that because we are not adopting First Economics' or NERA's forecasts that our forecasts for all inputs will be substantially different for every scenario. This is further reinforced because as discussed below we rely on some of the indices used by First Economics and NERA to make our forecasts.

In order to make forecasts about future input prices we would have liked to have considered the relationship between input prices for the different components for each DNO and a range of possible indices that could be used as a basis for the forecast to enable us to establish robustly the most suitable indices to use in order to forecast the DNO's input price inflation. However, Ofgem has only been able to provide one year's worth of historical information for the different input price components, so it has not been possible to test these relationships with any rigour. For future price control reviews we consider that Ofgem's forecasting would benefit from having more historical information to use as a basis for establishing the most suitable indices.

Recognising the limitation this lack of information places on our ability to determine the indices most relevant to the DNOs to use as a basis for forecasting, we have instead made use of the RPI inflation scenarios and considered the strength of relationship between RPI inflation and the various indices. While there is no "rule" about the strength of the correlation coefficient between RPI inflation and the given index that would ideally be found, we have sought where possible to use correlation coefficients of at least 50%. However, particularly for materials, this has not always been possible given the extreme volatility of these input costs in recent years.[25]

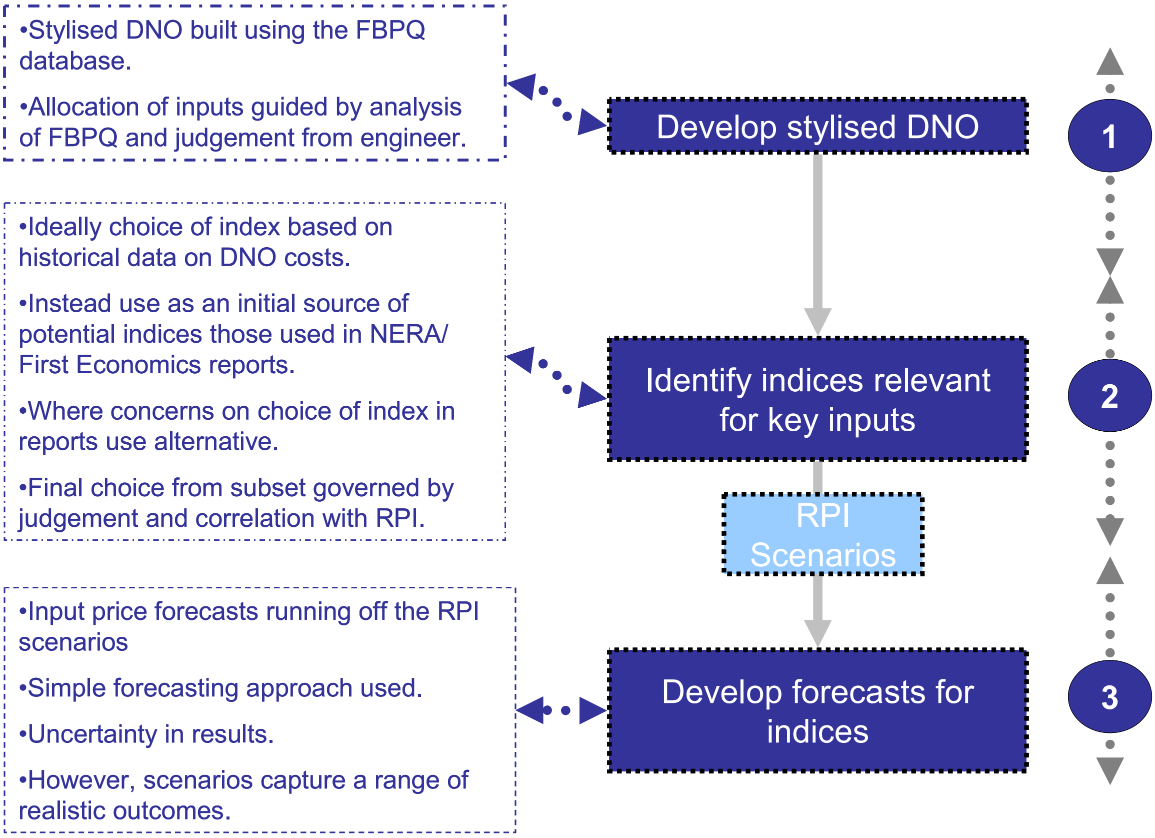
Our approach to forecasting based around three scenarios and choosing a limited number of indices recognises that in our view there is very significant uncertainty regarding future macroeconomic conditions, and this is a more important consideration for forecasting than the precise method used for forecasting each input price inflation. Indeed our approach of using a more limited number of indices within the context of the

[25] A more detailed explanation of the forecasting approach used in this analysis is provided in Annex 3.

overall scenarios is based on a view that given the degree of macroeconomic uncertainty other approaches, a more granular forecast of real input price inflation would suggest a degree of spurious accuracy on the part of any particular forecast.

Overall the approach used to develop the input price forecasts can be summarized in figure 4.1 below.[26] We discuss each stage of the process in the sections that follow.

Figure 4.1: Approach used to develop input price forecasts



4.3. A stylised DNO

To produce the input price forecasts, we first had to establish the primary inputs used by the DNOs. We developed a model to identify the main inputs used by the DNOs and the proportion of expenditure allocated to each input. The final judgement on the classification of the DNO's cost included consultation with specialist engineers. We did not have the opportunity to verify our conclusions with Ofgem or the DNOs, so the stylised DNO should be seen as an indicative measure rather than a definitive view. The composition of a stylised DNO is not particularly important for individual real input price inflation forecasts, but aids overall comparison of results.

Ofgem provided us with information to establish the composition of a stylised DNO in terms of inputs, and this information was provided separately for business costs and network costs, consistent with Business Plan Questionnaire classifications. We have

[26] A similar approach was used to produce the forecasts for the more minor inputs presented in Annex 4.

used this data to develop a stylised DNO, using the information provided by each of the DNO's for the period 2005/ 06 to 2007/ 08 and the forecasts for 2008 / 09 to 2014/ 15.

Tables 4.1 to 4.4 below set out the stylised DNO, detailing the main inputs and proportion of expenditure for each input for the stylised DNO. [27] Table 4.1 shows the stylised DNO for the category of business costs used by Ofgem in the Business Plan Questionnaire (BPQ). 75% of the costs are made up of labour costs.

Table 4.1: CEPA stylised DNO Business costs

Input	Proportion of costs
General labour	50%
Contractor labour (opex)	25%
Materials – general	10%
Other	15%

Source: Ofgem and CEPA analysis

Table 4.2 shows the stylised DNO for the category of network operating costs used by Ofgem in the BPQ. 90% of the costs are made up of labour costs, which is higher than for business costs, mainly because of a reduced proportion accounted for by materials costs.

Table 4.2: CEPA stylised DNO Network Operating costs

Input	Proportion of costs
General labour	40%
Contractor labour (opex)	50%
Materials – general	5%
Other	15%

Source: Ofgem and CEPA analysis

Table 4.3 shows the stylised DNO for the category of operational costs used by Ofgem in the BPQ. The DNO's operating costs are equal to the business costs added to the network operating costs. Approximately 80% of the costs are made up of labour costs.

Table 4.3: CEPA stylised DNO Operational costs

Input	Proportion of costs
General labour	45%
Contractor labour (opex)	35%
Materials – general	10%
Other	10%

Source: Ofgem and CEPA analysis

[27] The proportions presented in tables 4.1 to 4.4 have been rounded (to the nearest 5%) for ease of presentation. The calculations which follow use the non-rounded proportions generated by the model.

Table 4.4 shows the stylised DNO for the category of network capital expenditure used by Ofgem in the BPQ. While 65% of the costs are made up of labour costs, there is a greater proportion of the costs than for other categories for materials and plant and equipment.

Table 4.4: CEPA stylised DNO Network capital expenditure:

Input	Proportion of costs
General labour costs	50%
Specialized labour costs	15%
Materials – general	10%
Materials – specialized	15%
Equipment/ Plant costs	10%

Source: Ofgem and CEPA analysis

Table 4.5 draws together the results in tables 4.3 and 4.4 to develop an overall split of costs for DNOs, which shows that the majority of costs (75%) are made up of costs associated with the DNO's labour.

Table 4.5: CEPA stylised DNO and description of activities carried out by each input

Input	Proportion of costs	Description
General labour costs	50%	Equivalent to the make up of the general workforce
Contractor labour (opex)	20%	Contractors with specialized skills, primarily electrical engineers
Contractor labour (capex)	5%	Contractors with a range of engineering, planning, project management and surveying skills
Materials – general	10%	All material excluding specialized materials (e.g. bricks / concrete, fittings, fixtures, etc.)
Materials – specialized	5%	Basic Metals like Copper, Aluminium and Steel etc., as used in main equipment such as transformers, cables, cable containment, overhead lines and switchgear
Equipment/ Plant costs	5%	All plant and equipment used for various manufacturer works (e.g. extruders, welding & lifting equipment, transport, etc.) or rented/used at sites which is not integral part of the network (e.g. mobile generators, site offices, lifting plant, testing equipment, transport, etc)
Other	5%	A general mix of goods and services

Source: Ofgem and CEPA analysis

4.4. Choice of indices

As explained above, our ideal starting point when determining which indices to use would have been to use historical cost information from DNOs for the different inputs to establish the indices that most reflect the DNO's activities. This has not been possible because the necessary historical information is not available. Therefore, we have focused on the correlation coefficient between indices and RPI inflation to identify the indices for each of the scenarios discussed in Section 2. We have also tested the correlation coefficient of the indices with other factors, such as GDP growth, but generally found these correlation coefficients to be weaker.

The initial set of indices that we looked at was based on the indices analysed by First Economics and NERA in their respective reports. The final choice of index was governed by the strength of the correlation coefficient of the given index with RPI and our own judgement on the relevance of the given index to the typical business requirements of the DNOs. Table 4.6 below shows the correlation coefficient between RPI and an index for each of the components of operational expenditure.

Table 4.6: Indices used to generate input price forecasts for DNO's operational costs

Business area	Index	Source	Correlation coefficient with RPI
General labour	Private Sector Average Earnings Index (including bonus)	ONS Average Earnings data	0.53
Basic Materials	BCIS building costs materials index	BCIS	0.65
Other	RPI	ONS RPI index	-

Source: ONS, BERR and CEPA analysis

Table 4.7 shows the correlation coefficient between RPI and an index for each of the components of capital expenditure.

Table 4.7: Indices used to generate input price forecasts for DNO's capital expenditure

Business area	Index	Source	Correlation coefficient with RPI
General labour	Private Sector Average Earnings Index (inc. bonuses)	ONS Average Earnings data	0.53
Basic materials	BCIS general building costs index	BCIS	0.65
Specialist materials	BEAMA Basic materials electrical index	BERR	0.26
Equipment/ plant costs	ONS Electrical machinery and apparatus	ONS	0.55

Source: ONS, BERR and CEPA analysis

As can be seen from the tables the correlation coefficients for labour costs are reasonably strong, and therefore quite a good basis for rolling forward forecasts. The correlation coefficients for specialist materials are much weaker, which reflects the large volatility in materials costs in recent years. First Economics' noted in its report the significant difficulties in producing point estimates of materials and plant and equipment costs at the current time.

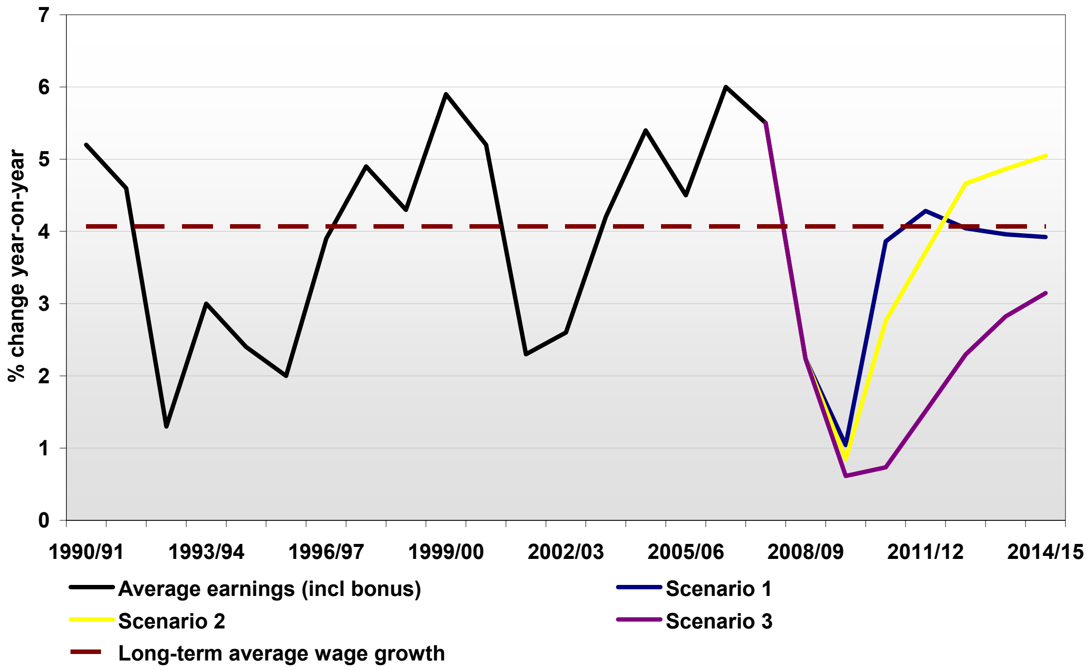
4.5. Forecasts

We set out in turn below the forecasts for each scenario. Given the importance of labour costs to the DNO (approx 75% given the stylised DNO), we separately develop forecasts for the DNO's labour costs (both general and specialised labour). We then produce forecasts for the materials and equipment/ plant inflation. Given the level of instability in the global commodities markets these are subject to more uncertainty and should be interpreted as such. For the costs classified as 'other' we use the RPI forecasts because we feel that the mix of goods and services contained in the DNO's 'other' basket would, more or less, reflect inflation in the general economy. Annex 4 provides more granular forecasts for many of the goods and services contained in the DNO's 'other' basket. A more detailed explanation of the forecasting approach is provided in Annex 3. As explained in these annexes, these forecasts are intended to primarily be illustrative because we have concerns that forecasting at this level of granularity implies a degree of spurious accuracy given the range of uncertainties.

4.5.1. General labour

Figure 4.2 shows our forecasts for general labour input price inflation for each of the scenarios. The forecast is developed using the forecasting approach explained above and is based on an analysis of all available average earnings data. Ideally we would prefer to analyse the relationship between wages and inflation over three or at least two full business cycles, however the private sector (including bonus) average earnings data, which is the more relevant earnings index for the DNOs is available only since 1990.

Figure 4.2: Forecasts for general labour wage growth (nominal % change)



Sources: ONS and CEPA analysis

It is important to note that under all of the scenarios we are assuming that general labour costs will not fall in nominal terms, which reflects an underlying stickiness in nominal wages. However, we are forecasting that real wage increases in some years of some scenarios may be quite low. We consider this is realistic given the increased labour market flexibility that has been experienced in recent times due to factors such as the increased levels of migration and the increase in unemployment experienced since 2008.

In terms of the three scenarios the forecasts for wage growth correspond as follows:

- In **Scenario 1** we are presenting an optimistic course for the economy, in which economic activity quickly returns to trend by 2010/11. As shown in figure 4.2 in these circumstances we would expect nominal wage growth to fall during the worst years of the recession, before quickly returning to a similar trend experienced over the last economic cycle.

- In **Scenario 2** we are assuming that the recession is more prolonged, and leads to higher costs of borrowing towards the end of DCPR5 due to increased regulation of the financial sector and resultant higher interest rates. As a result as shown in figure 4.2 it takes longer for wage growth to return to trend. By 2013/14 wage growth accelerates past trend growth levels when workers demand higher wages as the economy recovers in response to the higher costs of borrowing and corresponding higher costs of repaying mortgages.

- In **Scenario 3** we are presenting a more prolonged 'L' shaped recession, which leads to general deflation in the economy. As a result as shown in Figure 4.2 wage growth remains below trend throughout DPCR5. Note that given our assumption that wages do not fall in nominal terms, wage growth will increase in real terms in scenario 3 because of the level of deflation.

4.5.2. Contractor labour

When producing forecasts for the wage growth of the contractors employed by the DNOs, the key question that needs to be answered is the extent to which the wages of the DNO's contracted labour will experience wage growth that is significantly different from the general labour force over the forecast period.

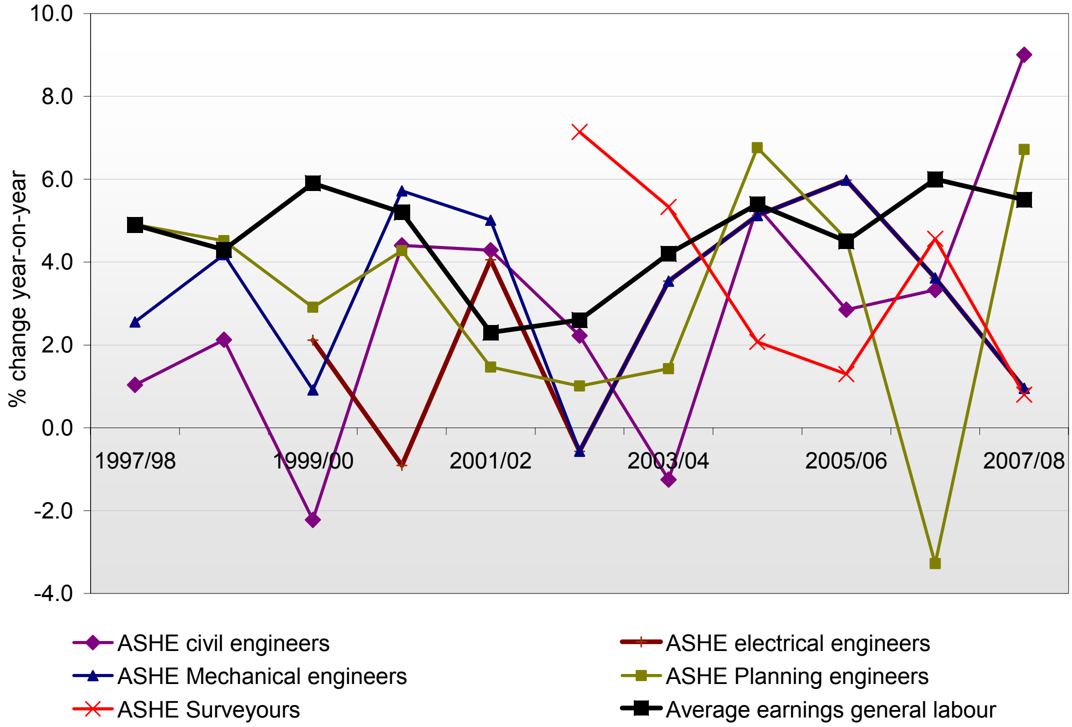
The first thing that we need to do is to classify the type of contractors employed by the DNOs. Table 4.5, above, provides such a classification, showing that the majority of the DNO's contracted labour are electrical engineers, with the remainder having specialist engineering; surveying, and planning skills.

To understand how the wage growth of contracted labour with the mix of skills detailed above might vary when compared to the wage growth of the general labour force, we analyze the trends in wage growth of the general labour force and compare them to the trends in wage growth of the 'specialist' workforce of the DNOs. This takes account of the fact that a key determinant of the wage growth of contracted labour will be the prevailing conditions in the labour market. For instance, in periods of high growth and employment, contracted labour would typically become relatively more scare and be in a better bargaining position to negotiate higher wage packages than the general labour force. However, when the labour market is less secure, companies will most likely let go of contractors before shedding permanent employees, and would generally be in a better position to negotiate down the wage claims of any perspective contractors. In this regard it is also important to consider that the wages of contractors will be set more frequently than the wages of the DNO's general workforce, and thus contractor wages will affected by prevailing economic conditions more acutely. There is evidence throughout the economy of companies unilaterally imposing cuts in level of contractors' remuneration.

Figure 4.3 below shows data from the ONS Annual Survey of Household Earnings, which compares year on year wage growth of the general labour force with wage growth experienced by workers classed as civil, mechanical, electrical and planning engineers, and also the wage growth experienced by surveyors.[28]

[28] Data from the ASHE is only available since 1997, though the ONS plan to publish data going back to 1992 in the future. See http://www.statistics.gov.uk/downloads/theme_labour/ashe/faq.pdf for additional information.

Figure 4.3: Nominal wage growth in the engineering sector compared to the general labour force

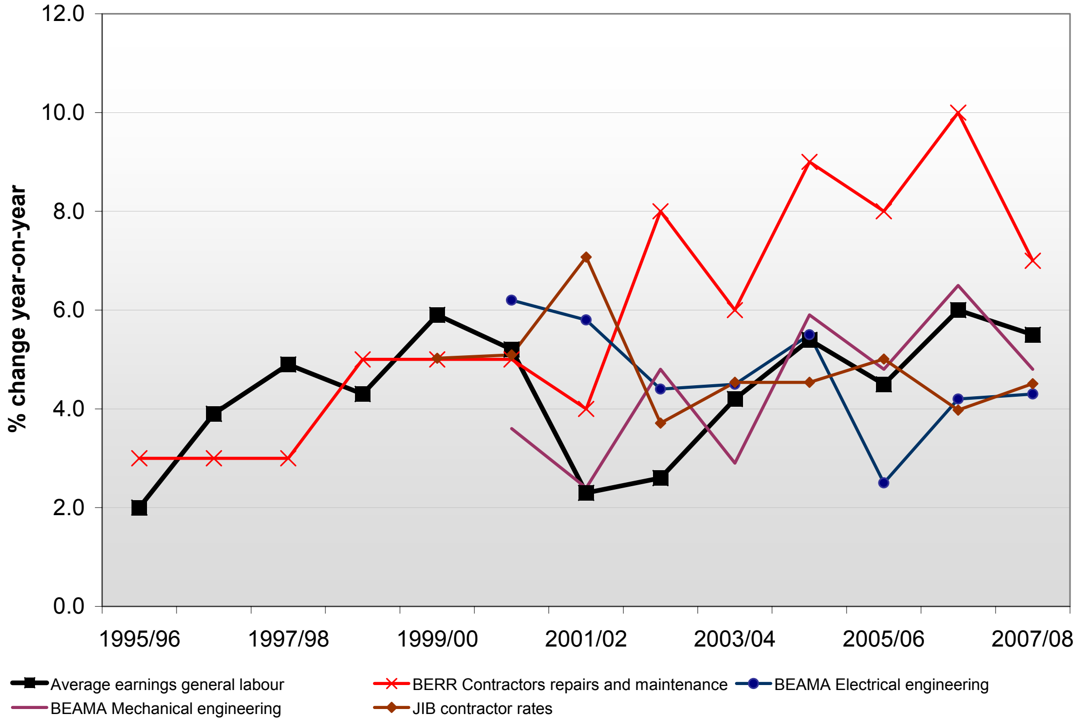


Source: ONS

Figure 4.3 provides no evidence to suggest that workers employed in sectors similar to the DNO's contracted workforce have experienced significantly higher wage growth than the general workforce over the economic cycle. In particular the wage growth of electrical engineers has averaged just 2.7% over the past 10 years compared to the 4.1% long-term average wage growth experienced in the general economy among private sector employees.

In addition to the ONS earnings data, institutions such as the BERR, BEAMA, and the JIB all produce indices which seek to capture costs incurred by employers when they employ contracted labour with engineering skills, including some of the overheads associated with employing contracted labour. Figure 4.4 below compares average earnings data from the private sector (including bonus) to the BERR contractors (repairs and maintenance); BEAMA Electrical Engineering Index; BEAMA Mechanical Engineering Index; and the JIB Contractor Rates Index.

Figure 4.4: Wage growth in the general labour force compared to a selection of indices (nominal year on year % change)



Sources: ONS, BEAMA, BERR and JIB

Table 4.8 compares the average year on year percentage change of the selected indices compared to year on year average earnings growth.

Table 4.8: Average wage growth in the general labour force compared to indices measuring costs of employing engineers[29] (% change year-on-year)

Index	Average over dataset	Average over economic cycle	Differential Vs. private sector earnings
Private sector average earnings (incl. bonuses)	4.1	4.5	n/a
BERR contractor: repairs and maintenance	5.8	6.7	+2.2
BEAMA Electrical engineering index	4.7	4.7	+0.2
BEAMA Mechanical engineering index	4.5	4.5	0
JIB Contractor rates	4.8	4.8	+0.3

Sources: ONS, BEAMA, BERR, JIB

[29] Average over dataset is the average taken from all the data that we had available from the respective index, whereas the average over the economic cycle is the average over the period 1997/98 to 2007/08 (or the nearest approximation given data availability) based on HM Treasury's definition of the last economic cycle.

An analysis of Figures 4.3 and 4.4 and Table 4.8 suggests that the wages of the contracted labour employed by the DNOs has not grown significantly more when compared to the general labour force. However, an analysis of the indices suggests that over the economic cycle there are times when the wages earned by the specialised labour force grow more and less quickly than the wages of the general workforce; that is, there is greater variance according to what is happening in the economic cycle. Of the indices shown in Figure 4.4, only the BERR contractor wages index shows much higher wage growth than the average earnings for any sustained period of time. However, towards the end of the economic cycle this index has also begun to experience similar levels of wage growth to the rest of the private sector. The BEAMA electrical engineering index has grown on average only 0.2% more than average earnings over the previous economic cycle. This needs to be analyzed in the context of the high and stable economic growth achieved in the economy over the previous economic cycle, and the robust growth experienced in the construction sector more specifically.

Over DPCR5 some research has suggested that one-off events such as the Olympics and the construction of Crossrail may create a significant additional demand for the contractors employed by the DNOs. However, the recession has already significantly reduced activity in the construction sector. Data released by the ONS in March 2009 suggests that the construction sector declined by a substantial 4.9% in the fourth quarter of 2008 alone. This will reduce significantly demand for labour with the type of skills employed by the DNOs over the medium-term, and thus significantly reduce the ability of contractors to negotiate higher wage growth than the general labour force. Indeed anecdotal evidence suggests that many individuals employed as contractors are currently accepting nominal wage cuts to keep their jobs with reports of workers accepting wage cuts of up to 20% to keep their jobs.

Overall, the evidence suggests that over the forecast time-horizon the specialised labour employed by the DNOs will not experience significantly higher growth than the general labour force. Indeed, based on the current state of the economy, and the recent significant increase in unemployment, we would expect a prolonged recession to cause contracted workers to experience lower wage growth than the general workforce. In Table 4.9 below we set out our view of the wage growth 'premium' for the DNO's contracted labour compared to the assumptions set out in the First Economics and NERA reports.

Table 4.9: Wage growth 'premium' for the DNOs' contracted labour CEPA view compared to First Economics and NERA (% premium per annum)[30]

	'Premium'
CEPA Scenario 1	0
CEPA Scenario 2	-0.5
CEPA Scenario 3	-1
First Economics – electrical engineers	0.75
First Economics – skilled infrastructure specialists	1.5
NERA	0.9

Sources: First Economics, NERA and CEPA analysis

As shown in Table 4.9 we assume a smaller premium in both scenarios 2 and 3 respectively, because we assume a longer recession in both these scenarios and would therefore expect the bargaining power of contractors to be reduced by more in each of the scenarios. The assumptions made suggest significantly lower wage growth for the DNO's contracted workforce over DPCR5. However, based on the current state of the economy and predicted increases in unemployment over the next year the assumptions may turn out to be conservative. Indeed, given the recent decline in construction activity, projects such as the Olympics may play a key role in preventing contracted workers from experiencing significant nominal wage cuts, given the potential severity of the recession.

Therefore, to develop a forecast for the DNO's specialised labour force we use the forecasts that we have developed for the wage growth of the general labour force over DPCR5 and subtract the premium stated in Table 4.9 above in each of the scenarios.

In the sections that follow we present results for each of the three scenarios, before providing a comparison of CEPA's analysis with the other reports.

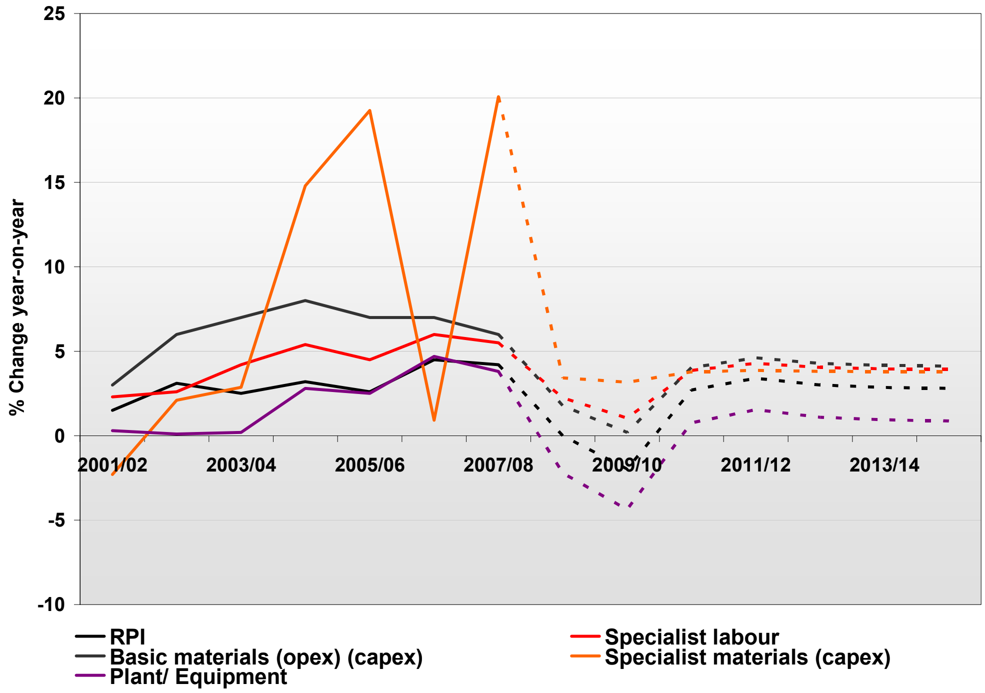
4.5.3. Scenario 1

Figure 4.5 and Tables 4.10 and 4.11 set out our forecasts for scenario 1, which was the optimistic case with regard to macroeconomic developments. Consistent with the assumptions underlying this scenario, the results show downward pressure on input price inflation in 2009/10 before a reversion to previous trend levels by 2011.

Figure 4.5 shows the nominal input price inflation forecasts for the different components of DNO's cost base, along with the forecast for RPI. Historical information is also shown for information. Figure 4.5 shows a sharp decline in nominal input price inflation before a sharp recovery and a general return to trend by 2011/12.

[30] Table 4.9 shows the approximate % wage growth premium assumed for the DNO's contracted labour over the forecast period in the First Economics, NERA, and CEPA analysis.

Figure 4.5: Input price forecasts for scenario 1 (% change in nominal terms)



Source: CEPA analysis

Table 4.10 presents the results for Scenario 1 for the real price trends for the inputs relevant to the DNO's operating costs based on CEPA's stylised DNO. The results are shown from the beginning of the forecast period (2008/09) to the end of DCPR5.

Table 4.10: Operational costs forecasts for scenario 1 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general
2008/09		2.2	2.2	1.8
2009/10		3.0	3.0	2.2
DPCR5	2010/11	1.2	1.2	1.3
	2011/12	0.9	0.9	1.2
	2012/13	1.0	1.0	1.3
	2013/14	1.1	1.1	1.3
	2014/15	1.1	1.1	1.3
	Average	*1.1*	*1.1*	*1.3*
Average for 2008/9-2014/15		*1.5*	*1.5*	*1.5*

Source: CEPA analysis

Table 4.11 presents the results for Scenario 1 for the real price trends in the inputs used in the DNO's capital costs according to CEPA's stylised DNO over the forecast period and DCPR5.

Table 4.11: Capital costs forecasts for scenario 1 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general	Materials - specialized	Equipment / plant
2008/09		2.2	2.2	1.8	3.4	-2.2
2009/10		3.0	3.0	2.2	5.1	-2.4
DPCR5	2010/11	1.2	1.2	1.3	1.1	-1.9
	2011/12	0.9	0.9	1.2	0.5	-1.9
	2012/13	1.0	1.0	1.3	0.8	-1.9
	2013/14	1.1	1.1	1.3	0.9	-1.9
	2014/15	1.1	1.1	1.3	1.0	-1.9
	Average	*1.1*	*1.1*	*1.3*	*0.9*	*-1.9*
Average for 2008/9-2014/15		*1.5*	*1.5*	*1.5*	*1.8*	*-2.0*

Source: CEPA analysis

As we discuss further below when we summarise the overall results, as this scenario involves a relatively quick reversion to the trend growth for the UK economy, the scenario forecasts that input price inflation for DNOs will generally outstrip inflation, apart from the equipment/ plant component. The forecasts for equipment/ plant in particular and materials are both subject to a greater degree of uncertainty than the labour forecasts.

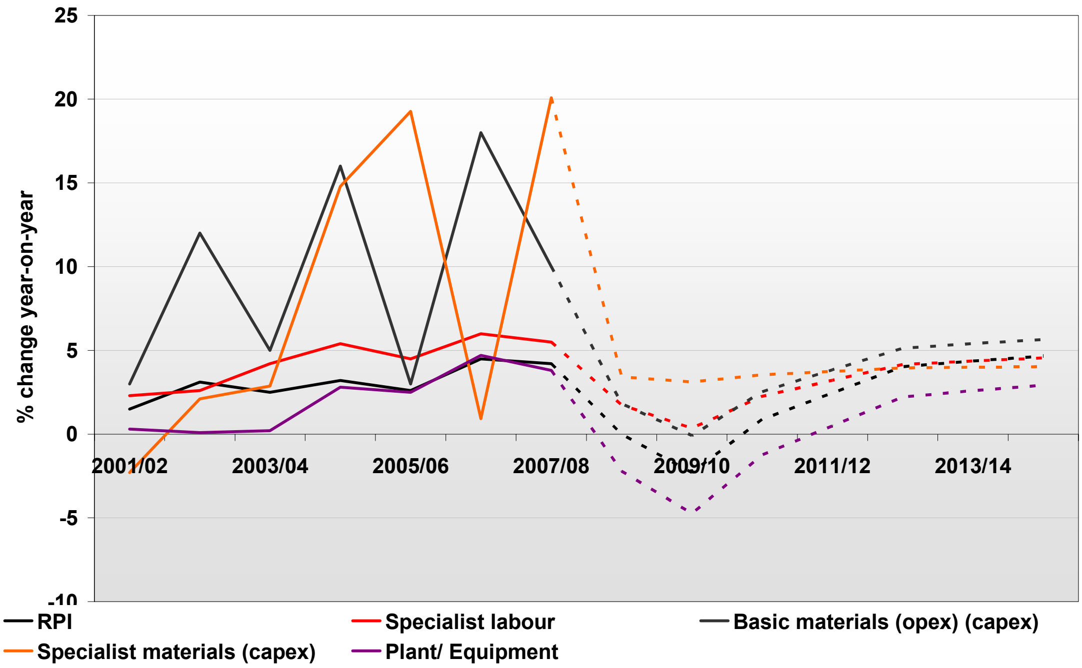
Overall, the results for scenario 1 are generally consistent with the argument set out by First Economics that the cost base of DNOs is sufficiently different from the general mix of inflation indices in ways that create greater cost pressures, than the basket of goods that comprise most inflation indices. In particular, DNOs have to rely almost exclusively on UK based labour, whereas items such as clothing within inflation baskets rely largely on lower cost labour from overseas.

4.5.4. Scenario 2

Figure 4.6 and Tables 4.12 and 4.13 set out our forecasts for scenario 2, which was the prolonged crisis case with regard to macroeconomic developments. Consistent with the assumptions underlying this scenario and similar to scenario one, the results show downward pressure on input price inflation in 2009/10 before a slower pick-up than under scenario one before inflationary pressure takes hold on the economy caused by monetary policy and subsequent increased wage claims.

Figure 4.6 below illustrates the nominal price growth for the DNO over the forecast period under the assumptions set out in Scenario 2, and shows the historical trend in nominal input price inflation. Figure 4.7 shows that input price inflation falls significantly reaching a trough in 2009/10 but towards the end of DCPR5 because of increased inflationary pressures in the economy, input price inflation increases slightly more in nominal terms than in Scenario 1.

Figure 4.6: Input price forecasts for scenario 2 (% change in nominal terms)



Source: CEPA analysis

Table 4.12 below presents the Scenario 2 input price inflation forecasts in real terms for the inputs relevant to the DNO's operating costs according to CEPA's stylised DNO.

Table 4.12: Operational costs forecasts for scenario 2 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general
2008/09		2.2	1.7	1.8
2009/10		3.1	2.6	2.2
DPCR5	2010/11	1.9	1.4	1.7
	2011/12	1.3	0.8	1.4
	2012/13	0.6	0.1	1.1
	2013/14	0.5	0.0	1.0
	2014/15	0.4	-0.1	1.0
	Average	*0.9*	*0.4*	*1.2*
Average for 2008/9-2014/15		*1.4*	*0.9*	*1.5*

Source: CEPA analysis

Table 4.13 below sets out the results of the input price forecasts for the DNO's inputs used in capital expenditure in scenario 2. The results are presented in real terms showing the year on year % change.

Table 4.13: Capital costs forecasts for scenario 2 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general	Materials - specialized	Equipment / plant
2008/09		2.2	1.7	1.8	3.4	-2.2
2009/10		3.1	2.6	2.2	5.4	-2.4
DPCR5	2010/11	1.9	1.4	1.7	2.7	-2.1
	2011/12	1.3	0.8	1.4	1.3	-2.0
	2012/13	0.6	0.1	1.1	-0.1	-1.8
	2013/14	0.5	0.0	1.0	-0.4	-1.8
	2014/15	0.4	-0.1	1.0	-0.6	-1.7
	Average	*0.9*	*0.4*	*1.2*	*0.6*	*-1.9*
Average for 2008/9-2014/15		*1.4*	*0.9*	*1.5*	*1.7*	*-2.0*

Source: CEPA analysis

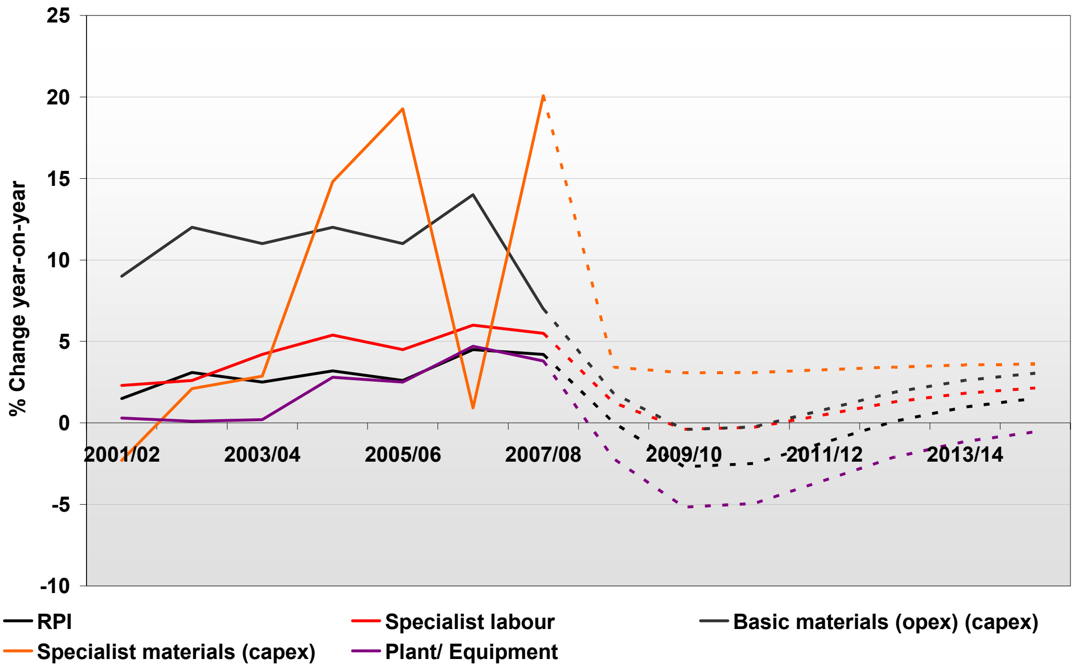
Tables 4.12 and 4.13 show lower real wage growth for both the DNO's general labour force and for its contracted labour. This is an interesting feature of the results. Under the conditions specified in scenario 2 we would be expect this to occur partly because in periods of higher inflation wage growth will typically lag general inflation, because of the increased uncertainty: because workers see their cost of living rising they demand higher wages but can end up experiencing lower wage growth in real terms than in periods of lower inflation. Furthermore, with GDP forecast to be lower in Scenario 2 the scope for employers to offer higher wage growth to match higher levels of general inflation is reduced.

4.5.5. Scenario 3

Figure 4.7 and Tables 4.13 and 4.14 set out our forecasts for scenario 3, which was the deflation trap case with regard to macroeconomic developments. Consistent with the assumptions underlying this scenario there is a steep initial drop in input prices and a slow pick-up with a reversion to a much lower trend level.

Figure 4.7 below illustrates the nominal price growth for the DNO over the forecast period, and also shows the historical trend in nominal input price inflation for the given inputs. The figure shows a decline in nominal prices in % terms for the inputs followed by a gradual increase in nominal input price inflation towards the end of DCPR5. Though under the conditions set out in Scenario 3 input price inflation remains below trend, in nominal terms, throughout DCPR5.

Figure 4.7: Input price forecasts for scenario 3 (% change in nominal terms)



Source: CEPA analysis

Table 4.14 below sets out the forecasts for Scenario 3 for input price inflation in real terms for the inputs relevant to the DNO's capital expenditure based on CEPA's stylised DNO.

Table 4.14: Operational costs forecasts for scenario 3 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general
2008/09		2.2	1.2	1.8
2009/10		3.3	2.3	2.3
DPCR5	2010/11	3.2	2.2	2.2
	2011/12	2.7	1.7	2.0
	2012/13	2.2	1.2	1.8
	2013/14	1.8	0.8	1.6
	2014/15	1.6	0.6	1.5
	Average	*2.3*	*1.3*	*1.8*
Average for 2008/9-2014/15		*2.4*	*1.4*	*1.9*

Source: CEPA analysis

Table 4.15 below sets out the results of the input price forecasts for scenario 3 in real terms for the DNO's capital expenditure under the assumptions set out in Scenario 3.

Table 4.15: Capital costs forecasts for scenario 3 (% change year-on-year in real terms)

		General labour	Specialist labour	Materials – general	Materials - specialized	Equipment / plant
2008/09		2.2	1.2	1.8	3.4	-2.2
2009/10		3.3	2.3	2.3	5.8	-2.5
DPCR5	2010/11	3.2	2.2	2.2	5.6	-2.5
	2011/12	2.7	1.7	2.0	4.5	-2.3
	2012/13	2.2	1.2	1.8	3.3	-2.2
	2013/14	1.8	0.8	1.6	2.6	-2.1
	2014/15	1.6	0.6	1.5	2.1	-2.1
	Average	*2.3*	*1.3*	*1.8*	*3.6*	*-2.2*
Average for 2008/9-2014/15		*2.4*	*1.4*	*1.9*	*3.9*	*-2.3*

Source: CEPA analysis

The results for this scenario, shown in tables 4.14 and 4.15 above, exhibit much lower levels of nominal input price inflation than in the other two scenarios. However, when presented in real terms the results may appear somewhat counterintuitive, as Scenario 3 shows higher input price inflation in real terms than Scenarios 1 and 2. However, this is explained simply by the importance of UK labour to the DNO's costs. Given our assumption that wages will typically not fall in nominal terms, and our assumed course for RPI over Scenario 3 we would expect real wage growth to be high. In periods of deflation it is typically unemployment that rises as a result of workers general reluctance to accept nominal wage cuts.[31]

While it is difficult to be certain about future macroeconomic developments, the results of this scenario might reasonably be regarded as less likely to occur, so we would therefore attach more weight to both scenarios one and two.

4.6. Summarising and comparing results

To aid comparison of forecasts, we have compared the forecasts for each of our scenarios with those developed by First Economics, which had a comparable coverage for their forecasts. Where there is an equivalent forecast from NERA, we also quote the NERA forecast. The comparisons are made on the basis of the stylised DNO we developed using information provided by Ofgem. The relevant breakdowns of the different input cost elements for each stylised DNO are shown in Annex 2.

In tables 4.16 to 4.20 which follow we provide a comparison of the results. Where we quote First Economics report, the number is taken directly from First Economics paper (December 2008), whereas the results presented as 'First Economics' use the specific input price and RPI forecasts made in the First Economics (December 2008) paper to

[31] See for instance: Groth, C. (2009) 'Deflation', Bank of England Quarterly Bulletin, Q1 2009, pp. 37-44.

produce a forecast on a like for like basis with the CEPA analysis, i.e. some of the differences shown in the following forecasts between First Economics (December 2008) is due to the different assumptions on the input mix of the stylised DNO. By presenting the forecasts on a like for like basis we can strip out the affect that this might have on the different input price inflation forecasts.

Table 4.16 below sets out the average year on year percentage change in real prices for the inputs relevant to the DNO's operational costs as classified in CEPA's stylised DNO. Table 4.16 shows that CEPA makes materially different inflation forecasts for the DNO's contracted labour and materials inputs. Real price inflation is forecast to be higher for the DNO's general labour in Scenario 3 because of our 'sticky' downwards assumption for wages.

Table 4.16: Operational costs (average % change over 2010/11 – 2014/15 in real terms)

Input	Scenario 1	Scenario 2	Scenario 3	First Economics (December 2008)	NERA
Labour – general	1.1	0.9	2.3	1.0	1.42
Contractor labour	1.0	0.4	1.3	1.9	2.4
Materials – general	1.2	1.3	1.8	1.9	-0.1
Other	0	0	0	0.9	n/a

Sources: First Economics, NERA and CEPA analysis

Table 4.17 below sets out the overall average year on year percentage change in real terms for the DNO's operational expenditure based on CEPA's stylised DNO. For the DNO's operating expenditure First Economics' forecasts are both higher than CEPA's forecasts for Scenarios 1 and 2 but lower than shown in Scenario 3. This is primarily explained by the different assumptions for the DNO's contracted labour.

Table 4.17: Overall forecast estimates for Operational expenditure (average % change over 2010/11 – 2014/15 in real terms)

	Overall forecast estimates
CEPA Scenario 1	0.9
CEPA Scenario 2	0.7
CEPA Scenario 3	1.7
First Economics	1.4
First Economics (December 2008)	1

Sources: First Economics and CEPA analysis

The results for the DNO's operational costs show that the forecasts for our scenarios 1 and 2 are quite similar, albeit it a little lower, than First Economics' December 2008 forecast, while our forecast for scenario 3 is much higher (when expressed in real terms) than First Economics' forecasts. The higher figure shown for First Economics, when calculated using CEPA's stylised DNO is primarily caused by their higher assumption for the wage growth for contracted labour over DPCR5.

Table 4.18 below sets out the average year on year percentage change in prices in real terms for the inputs relevant to the DNO's capital expenditure as classified in CEPA's stylised DNO. The most significant difference is again due to the different forecasts for the DNO's contracted labour, CEPA's forecasts for Scenarios 1 and 2 also show much lower input price inflation for the DNO's materials costs and for the equipment/ plant inflation.

Table 4.18: Capital expenditure (average % change over 2010/11 – 2014/15 in real terms)

Input	Scenario 1	Scenario 2	Scenario 3	First Economics (December 2008)	NERA
Labour – general	1.1	0.9	2.3	1.0	1.42
Contractor labour	1.0	0.4	1.3	2.6	2.4
Materials – general	1.2	1.3	1.8	1.4	-0.1
Materials – specialist	0.9	0.6	3.6	1.9	-0.1
Equipment/ plant	-1.9	-1.9	-2.2	1.4	n/a

Sources: First Economics, NERA and CEPA analysis

Table 4.19 below sets out the overall average year on year percentage change for prices in real terms for the DNO's capital expenditure based on CEPA's stylised DNO. For capital expenditure First Economics' forecasts are both significantly higher than CEPA's forecasts for Scenarios 1 and 2 but lower than scenario 3. This is primarily explained by the different assumptions for the DNO's contracted labour, real inflation is higher in scenario 3 because of our 'sticky' downwards assumption for wages.

Table 4.19: Overall forecast estimates for capital expenditure (average % change over 2010/11 – 2014/15 in real terms)

	Overall forecast estimates
CEPA Scenario 1	0.9
CEPA Scenario 2	0.6
CEPA Scenario 3	1.8
First Economics	1.4
First Economics (December 2008)	1.7

Sources: First Economics and CEPA analysis

Table 4.20 below sets out the overall average year on year percentage change of prices in real terms for the DNO's total costs based on CEPA's stylised DNO. We can see that the average forecasts for both Scenarios 1 and 2 are lower than the comparable forecasts produced by First Economics. The difference is primarily explained by lower inflation forecasts for the DNO's contracted labour and for the DNO's materials and equipment/ plant costs.

Table 4.20: Overall forecast estimates for total costs (average % change over 2010/11 – 2014/15 in real terms)

	Overall forecast estimates
CEPA Scenario 1	0.9
CEPA Scenario 2	0.6
CEPA Scenario 3	1.8
First Economics	1.4
First Economics (December 2008)	1.3

Sources: First Economics and CEPA analysis

Overall the comparison of results reinforces our view that the principal criticism of First Economics' report (and NERA's and Oxera's) is not necessarily the level of the forecasts that they made, but rather the lack of consideration of a range of alternative macroeconomic outcomes.

4.7. Summary

We have presented forecasts for three macroeconomic scenarios in this section. It is very difficult in our view to be confident about which of the scenarios is the most likely to occur. In overall terms the difference between scenarios 1 and 2 is not that large although there is a difference in the profile of input price inflation over the period. Scenario 3 is a much lower input price inflation assumption in nominal terms because of the prolonged nature of the economic slowdown and the much lower long term trend for growth that is assumed.

At this stage we would propose that Ofgem considers each scenario on a stand-alone basis. However, we would suggest that the following probabilities might be attached to the forecasts:

- Scenario 1 - 50%. Scenario 1 fits most closely to the consensus view for the performance of the UK economy over the medium-term.
- Scenario 2 - 35%. Scenario 2 is seen as a real possibility by many economists. Despite RPI year on year growth recently falling to 0%, CPI currently remains more than 1% above the Bank of England's target. If this situation persists over a significant period of time the Bank will have to increase interest rates potentially creating an outcome for the UK economy similar to the assumptions that guide Scenario 2.
- Scenario 3 - 15%. This scenario is seen as a possibility, but is less likely than scenarios 1 and 2. As stated above RPI has already fallen to 0%, and is expected to turn negative in the coming months. It is possible that this will lead to a prolonged period of deflation and disinflation in the UK economy, though we would expect this to be a less likely outcome for the UK economy.

We have not in this section presented forecasts for input price inflation at the lowest possible level of granularity; that is, by type of equipment, primarily because we consider any results for this type of analysis to be subject to a significant degree of uncertainty given the current economic climate. We have provided illustrative forecasts at a more granular level in Annex 5. The volatility seen in materials and plant and equipment input costs in recent years shows the difficulties of forecasting even over a relatively short period of time and at a relatively high level. We discuss for Workstream 3 whether these uncertainties and volatility justify a specific risk mitigation measure.

5. WORKSTREAM 2 – REVIEW AND CRITIQUE OF THE CONSULTANTS' REPORTS

5.1. Introduction

For Workstream 2 we have reviewed the following reports:

- Oxera – "Understanding infrastructure requirements – Impact of regional economic performance, Prepared for EDF Energy Networks", 6 August 2007.
- Oxera – "Prospects for housing developments and employment up to 2019, Prepared for EDF Energy Networks", 3 November 2008.

When setting out our review of the reports we have assumed that the readers of our review have access to all of these reports. While we have summarised the main elements and conclusions of each report, and some of the more detailed elements of the reports where relevant, we have not repeated all of the analysis or evidence presented in the reports.

One thing that is common to both papers and we feel is relevant to highlight at the beginning is that the purpose of Oxera's papers is different to our own paper. Oxera's reports are informed by the need to provide EDF Energy Networks (EDF henceforth) with projections on key variables which EDF would then feed into its models in order to calculate electricity demand growth and the corresponding need for investment. As such, Oxera's papers make projections that extend beyond DPCR5 and adjust many of the calculations for factors specific to EDF regions.

5.2. Oxera August 2007

Oxera was commissioned by EDF to provide an overview of the economic outlook that might affect its electricity distribution business up to 2025 (split into two periods – up to 2012 and 2013-2025). The projections required by EDF covered two distinct aspects:

- The first is related to investment in infrastructure renewal and/ or enhancement due to changes in load growth. Oxera was asked to project household and employment growth, which are inputs in EDF's load growth models, and to indicate how changes in energy policy and energy prices could affect consumption per-capita.
- The second is related to the cost of delivering an infrastructure network that matches the load growth needs outlined above, and may be seen as relating to operating expenditure and maintenance. This part of the Oxera paper focused on labour and material costs and was covered in the review section for Workstream 1.

In both areas, Oxera was asked to consider the degree of uncertainty around its projections. As we will discuss below, Oxera's explicit attempt to model uncertainty is the main strength of its paper, although we have some concerns about the approach adopted. It is important to recognise that given the major macroeconomic changes since

August 2007 there are inevitably aspects of the Oxera report, particularly relating to the results, which are unlikely to remain appropriate. Therefore, our review has focused as much on the methodology adopted, with a view to whether it could reasonably be updated, as on the actual results generated.

To review the August 2007 report we first consider its overall approach and then review in more detail the individual aspects of its analysis.

5.2.1. Overall approach and robustness

Oxera adopts a two-step approach to its consideration of drivers of regional load growth:

- It begins by making 'baseline' projections of the number of households, employment level (defined as the number of jobs available in a region) and the population size. These projections are derived from the Department for Transport's (DfT) Tempro programme.[32]
- In the second stage Oxera considers four variables (namely the housing market, in-migration, productivity growth and what it calls 'infrastructure constraints'[33]), which it believe represent risks around the baseline projection, and attempts to calculate their impact on the projections. In this part, Oxera relies mostly on historical data and projections of third parties.

As we noted above, the strength of Oxera's work is the fact that it takes risk into consideration and attempts to account for certain elements of uncertainty which it considers important. However, its specific approach to accounting for uncertainty also raises our biggest concern about Oxera's methodology, namely that it considers each risk element in isolation and does not explain whether this represents a coherent picture of the directions in which the UK economy might be heading over the period to 2025. This manifests itself in the adoption of unrelated third party projections which are also presented over different time scales, for example for different energy costs.

Additionally, Oxera presents its risk scenarios as though they are driven by exogenous forces, never appearing to consider endogeneity or dual causality, let alone attempt to model it. For example, when considering migration Oxera never discusses the choice of migration as an economic decision driven by the difference in potential income between the host country and the source country, which is the accepted way of thinking about migration in economic literature. Likewise, the impact on energy prices of income growth is presented without any discussion of the fact that energy costs are a factor of global economic activity, which would affect income growth in the UK via the demand for UK exports.

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[32] Tempro is a programme that provides projections of key economic inputs for transport analysis.

[33] By infrastructure constraints, Oxera means how the cost of water, energy and mitigation of climate change might affect average income growth.

5.2.2. Baseline projections

Oxera calculates baseline projections from the DfT's Tempro programme and presents these for the East (EPN), South East (SPN) and London (LPN) distribution regions. It projects total population growth of 2.49-3.87% over 2007-12 (period 1) and 6.49-8.35% for 2012-2025 (period 2). Oxera sees jobs increasing by a total of 5.37-6.06% during period 1 and 7.21-7.85% during period 2. Lastly, its interpretation of Tempro figures lead to a projected 4.76-6.89% rise in the number of households during period 1 and a further 9.92-13.13% rise in period 2.

Oxera's approach to estimating future growth in electricity meter points, which is based on the assumption that in general one would expect one metering point per household seems appropriate to us, as is its approach to reaching an estimate on the number of households based on dwelling growth projections. However, we feel that its assumption of a fixed relationship between the number of jobs and commercial electricity demand is too simplistic. We would expect electricity demand per worker to be positively correlated with the capital-labour ratio. The assumption adopted by Oxera might be more reliable in London than in other areas, which may have a higher manufacturing component to their economy. We consider this issue further in Section 6.

As for Oxera's reliance on Tempro projections, the specific deficiencies of Tempro are clearly outlined by Oxera in its paper[34] and we will not repeat them here. We do highlight, however, that our biggest concern about the Tempro-based projections is that they are almost entirely made through extrapolation of past trends and figures and make no attempt to account for current influences. This makes Tempro a suitable tool for conducting very long-term analysis (e.g. investment projects that would not be complete for at least another ten years), which is what it was originally designed for, but arguably a more limited mechanism for the purpose of understanding the electricity demand outlook for DPCR5.

Oxera attempts to illustrate the predictive strength of Tempro by using its parameters to make 'within-sample' projections from 1991 to 2001. But since the parameters are themselves derived from the actual trend over this period, the exercise has limited value.

5.2.3. Housing market

Oxera considers two drivers of the number of houses in a region – house prices and house plans. It looks at trends in real house prices, which are produced by deflating Nationwide's quarterly figures by RPI inflation, in each of EDF's three regions. Despite noting that real house price growth over the previous ten year was nearly four times as high as the historical trend[35] and noting clear cyclical patterns in the ratios of house prices in the three regions to the UK average[36], Oxera explicitly assumes there would be no correction in house prices whereas it seemed sensible to expect one to take place and,

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[34] See: Box 2.2 'Tempro' p. 4 and Table 2.1 'Assumptions underlying Tempro forecasts' p. 5.

[35] Table 3.1 'Average annual growth rates of UK real house prices' p. 16.

[36] Figure 3.3 'Regional ratios of house prices' p. 17.

with the benefit of hindsight, we know that a correction has indeed been taking place over the past year or so.

Furthermore, and considering that the Oxera report deals with a part of the UK that is renowned for above average planning control restrictions and a long-standing wedge between housing supply and housing demand, it is particularly strange that Oxera insists on looking at prices as a driver of household formation and not the other way around.

With regard to house plans, Oxera notes the persistent shortfall of housing completions compared to the targets set in regional plans. Overall, Oxera's risk analysis finds a range of -2% to +4% compared to its baseline forecast of the total number of households in the three regions in the period to 2025. This range is expanded to -4.5% to +5.5%, when the impact of migration is taken into account (see below). We consider that the depth of the current recession will only exacerbate the extent to which migration would impact the housing market.

5.2.4. In-migration

Oxera pays particularly close attention to migration (and even more specifically in-migration) since it notes that a high proportion of new migrants have tended to settle in the three regions distributed by EDF. Oxera uses data from the ONS and Government Actuary's Department (GAD) to develop high, low and principal scenarios for migration trends over the period to 2031. It then applies these projections to its earlier household estimates, assuming that migrants' household size corresponds to the UK average, and comes up with the -4.5% to +5.5% range noted in the previous paragraph.

We raise three concerns with Oxera's approach to migration:

- Oxera makes no attempt to consider migration as an economic decision driven by a better earning potential in the host country compared to the source country, as is the prevalent approach in academic literature. As a result, no attempt is made to consider that how different economic performances by the UK could result in different levels of migration.
- Oxera focuses on in-migration to the three regions distributed by EDF. However, it makes no consideration of whether existing residents decide to stay in the region and face higher house prices (at least in the short run, until more houses are built) or move to other regions.
- Oxera highlights the unique characteristics of recent immigrants in so far as their age, qualifications and the professions they settle into in the UK, but it makes no attempt describe how the characteristics of new immigrants distinguish them from UK residents as far as labour market participation, employment rate and household size are concerned.

5.2.5. Productivity growth

Oxera looks at Total Factor Productivity (TFP) based on ONS data for the UK. It makes international comparisons, looks at sector-specific productivity growth rates and compares the three EDF regions to the rest of the UK. It finds that productivity in the EDF regions (particularly London) has been somewhat higher than elsewhere in the UK over the period 1996-2005 and concludes that, based on a 2% growth trend in productivity (which is in line with historical observations), productivity in the three regions is likely to be slightly higher than the trend – i.e. 2-2.5% per year. All in all, Oxera calculates the total impact of TFP growth on average incomes per capita at +/- 6.3% of the central forecast in the period to 2025.

The main objection we raise to Oxera's findings is that the long-term trends it bases its projections on are highly unlikely to be appropriate for the economic climate of DPCR5.

5.2.6. Infrastructure constraints

In this section, Oxera attempts to determine the impact of higher water costs, energy costs, carbon emission standards and the transport infrastructure on productivity and average income growth. Its approach in the main is to interpret third party projections (mainly the Department for Business, Enterprise and Regulatory Reform, BERR) of future developments in these areas, particularly with regard to future oil, gas and coal prices and their implications for UK power costs.

We feel that the strongest part of this Oxera paper is its attempt to model the impact of a 30% end-user energy price shock on UK GDP growth, consumption, investment, net exports, inflation, the exchange rate and energy use. Based on models provided by Oxford Economics and Global Insight, Oxera calculates the impact on GDP of a 30% shock to energy prices at -0.8% to -0.9% during the first year, worsening to -2.1% after ten years in the Oxford Economics model but improving to -0.6% in the Global Insight model. Our main criticism of the approach, as we noted earlier, is that Oxera shows no consideration for dual causality and the fact that a substantial change in energy prices is unlikely to occur without a relevant change in the macroeconomic context.

5.2.7. Summary of the review

We consider that Oxera's approach of relying primarily on historical information to make an extrapolation about the future is a reasonable approach for longer term forecasts, but is unlikely to be appropriate for the short term given the uncertain macroeconomic conditions. The paper's heavy reliance on Tempro and third party forecasts may reduce the coherence and a better approach would have been to formulate a series of clear scenarios and model them across the range of relevant variables.

5.3. Oxera November 2008

For the November 2008 report, Oxera was commissioned by EDF to update its earlier projections on the drivers of load growth in light of the latest macroeconomic developments. Oxera's paper covers the period 2008-19 and relies in its analysis on a report dated August 2008 (which had not been made available to us). As we understand it, the terms of reference also required Oxera to provide an analysis of the residential and commercial property market in light of the latest developments affecting those particular markets, especially in the London area. As in its August 2007 paper, Oxera was asked to explicitly model the degree of uncertainty around its updated projections.

To review the November 2008 report we first provide an overview of its overall approach and then consider in more detail the individual aspects of its analysis.

5.3.1. Overall approach and robustness

Oxera's approach to forecasting remains largely unchanged from the August 2007 paper in that it relies heavily on the DfT's Tempro model to come up with estimates for population, household and employment levels. The main difference is that in this paper Oxera does not consider risk variables in isolation. Instead, it formulates three growth scenarios and considers their implications for the growth rate of residential metering points and employment levels. This answers our main criticism of the August 2007 paper and, indeed, provides clear quantitative illustrations of the impact of various growth scenarios on the drivers of load growth. As noted above, Oxera also dedicates a section to discussing the prospects for the commercial property market.

The other meaningful change from the August 2007 paper relates to Tempro. In the November 2008 paper, Oxera uses an updated version of Tempro (version 5.4, compared to version 5.3 used previously), which includes the latest increases in population according to the GAD. As a result, the model predicts higher employment and dwelling numbers for a given level of economic growth. Tempro does that because its projections are formed by extrapolating past trends and observations. As such, and as we noted above, Tempro is a useful tool for conducting very long-term analysis but a weaker tool for making short-term forecasts, as is necessitated for the purpose of understanding electricity demand during DPCR5. Oxera attempts to correct for Tempro's short-term failings through its utilisation of the aforementioned scenarios but, as we will discuss below, the outcome still has weaknesses.

Lastly, Oxera changes its definition of 'employment' from the number of jobs provided in an area to the number of workers who are employed. Oxera justifies the change by noting that EDF estimates industrial and commercial energy demand per employee. We discuss the implications of the change in methodology in section 5.3.4.

5.3.2. Economic growth

Oxera begins by discussing the latest macroeconomic developments and notes that they are likely to impact load-growth in the period to 2019 through three main avenues:

- lower supply of credit and higher cost of capital, which would depress investment and subsequently productivity;
- a potential reduction in the inflow of immigrants, resulting in a lower growth rate of the workforce and, therefore, output; and
- higher oil prices may weigh down on the growth path of productivity and potential output.

Oxera then compares the latest economic developments to the last three recessions experienced in the UK. It decides that the current situation most closely resembles the early 1990s recession in that house price and debt bubbles have been present at both times. But while noting that the "bubbles" are greater this time around, Oxera argues that there are mitigating factors which are likely to make the current recession less severe and less long-lasting than that of the early 1990s. In particular, it notes that inflation has been falling this time around, allowing the (already credible) Bank of England to lower interest rates. Secondly, it argues that government policy is helping to ease the crisis, rather than exacerbate it as has been the case in past recessions, by underwriting the banking system and by supporting the economy through fiscal measures. Lastly, it notes that the weaker sterling is likely to boost UK competitiveness and mitigate the risk of a Japan-style deflation trap.

Overall, Oxera makes the following assumptions about the nature of the current recession:

- it would last three to six quarters;
- the overall fall in GDP will amount to 1.5-2.25%; and
- the recovery will see GDP rising by an average of 2.6-3.3% in the five years that follow the recession.

Oxera then comes up with three scenarios for GDP growth in the period to 2019. These are:

- High case – GDP growth is flat in 2009, followed by a recovery to above-trend levels before settling back to its long-term trend (assumed 2.25% based on HM Treasury estimates) by 2015.
- Intermediate case – GDP sees four quarters of negative growth, followed by a somewhat slower recovery before settling back to trend by 2017.
- Low case – GDP falls by 1.5% during 2009 as part of a six quarter recession, followed an even slower recovery than the intermediate case and taking the UK economy until 2019 to settle back to its long-run trend growth rate.

We find the Oxera approach lacking in three main areas:

- The assumptions made about the depth and duration of the current crisis is far too optimistic and are already out of date. For example, by December 2008 the consensus forecast for UK GDP growth in 2009 was minus 1.5%, i.e. equivalent to Oxera's low case, and by February 2009 the consensus forecast had fallen to minus 2.7%.[37]
- The scenarios themselves show little variation in the actual performance of the UK economy over the entire period in consideration. Average GDP growth is 2.6% in the high case, 2.49% in the intermediate case and 2.38% in the low case.

[37] HM Treasury 'forecast for the UK economy – a comparison of independent forecasts', various issues.

No consideration is made for the possibility that the crisis represents a structural change that will result in the economy settling into a different long-term trend growth rate (for example as a result of tighter credit supply due to stricter regulation of financial institutes).

- It is not clear what is achieved by comparing the current situation to the recessions that followed the first and second oil price shocks of the 1970s since those recessions were driven by different factors to the ones causing the current recession. Oxera makes no explicit attempt to understand how the recovery of the UK economy is affected by a global recession, which is the one thing the current economic situation does have in common with the recessions of the 1970s.

5.3.3. Residential metering points

The first driver of electricity demand which Oxera forecasts is Metering Point Administration Numbers (MPANs), which is done by making the reasonable assumption of one MPAN per dwelling. Whereas its August 2007 paper dealt with forecasting the growth in household numbers, the November 2008 paper deals with dwelling numbers as these are available on Tempro by local authority districts – a level of disaggregation needed for EDF's purposes.

Oxera begins by considering the current situation in the housing market from the point of view of housing demand and housing supply. It notes that high but rapidly falling house prices are hitting the demand for houses. As for supply, it notes that the housing market is likely to be more responsive to short-term economic fluctuations than the commercial property market owing to the shorter lead times involved. Overall, Oxera sees reduced activity levels in the period ahead and argues that activity will not return to normal levels until credit markets and house prices return to more sustainable paths. Oxera, therefore, concludes that the economic downturn is likely to result in lower private housing investment and net additions to the stock of dwellings during the period under consideration.

In order to quantify the impact of the above on MPAN growth, Oxera uses the private housing investment equation in HM Treasury's macroeconomic model. To do so, it makes assumptions about house prices, the household final expenditure deflator and short-term interest rates as defined by the three-month LIBOR.

Oxera produces three paths for house prices, which correspond to its three growth scenarios. We support this approach and do not disagree with the actual figures used in these scenarios (nominal declines of 15%, 20% and 30% from summer 2007 to 2010 for the high, intermediate and low cases, respectively). Oxera uses the Department of Communities and Local Government's (DCLG's) house price index for its analysis. While we agree that this is the most accurate measure of house prices, it is published with some delay compared to alternative indices. As such, investors are more likely to focus on more instantaneous data such as the Halifax and Nationwide house price indices or forward-looking measures for the housing market such as the monthly statistics published by the Royal Institute of Chartered Surveyors (RICS).

Overall, Oxera's modelling finds that the growth rate of dwellings by 2019 would be somewhat lower than 2009 in the low case, a little bit higher than 2009 in the intermediate case and considerably higher than 2009 in the high case.

5.3.4. Employment

Oxera conducts analysis of the outlook for employment levels, which are used by EDF to proxy electricity demand from industrial and commercial activities. It does so by adjusting the Tempro projections according to the three growth scenarios using the employment equation in the HM Treasury macroeconomic model. The HM Treasury model defines employment as the number of jobs, which Oxera then converts to the number of workers, although it does not specify the parameters that it uses to make this conversion. One question that arises immediately is how Oxera accounts for part-time workers in its conversion. We also repeat our criticism of the August 2007 paper that no consideration is given to the fact that electricity demand is unlikely to have a fixed relationship with employment levels, but rather vary along with the capital-labour ratio.

5.3.5. Commercial property

In order to paint a picture of the commercial property market in the three EDF-distributed regions, Oxera analyses historic trends in rental yields, non-housing construction costs, employment in the financial services and commercial space availability to identify (in their view) the main factors which influence investment.

The conclusions made by Oxera are highly qualitative in nature and note the level of uncertainty involved in making any overall conclusions. Oxera argues that investors will see value in a market that has witnessed a significant downward correction and will find the opportunity to "buy low" attractive. Oxera argues that "*investors are likely to return to the commercial market sooner than occupiers, thus stimulating the market and making any given slowdown shorter*" (p. 32), but we would argue that since the current crisis has been driven by speculative borrowing, investors will find it much harder and more expensive to finance speculative activities on credit in the period ahead, especially as there is likely to be somewhat tighter regulation of lending.

5.3.6. Summary of the review

We feel that Oxera's more coherent approach to modelling risk in the November 2008 report is a positive development of the methodology it used in the August 2007 paper. Its application of three coherent growth scenarios to dwelling and employment level forecasts makes a good attempt at recognising the uncertainty that currently prevails. However, we still have misgivings about its use of a long-term projection tool (Tempro) to model short to medium-term variables. Furthermore, we feel that Oxera's forecasts were too optimistic, meaning that they are already out of date.

6. WORKSTREAM 2 – CEPA'S FORECASTS

6.1. Introduction

In this section we develop our own forecasts for employment and the number of new connections based on our three growth scenarios explained in Section 2. For both employment levels and the number of new residential connections, we present forecasts for each DNO region. We then carry out sensitivity analyses in order to derive the historical relationships between economic growth and electricity demand and between employment levels and electricity demands and use the former to come up with indicative (as opposed to detailed) forecasts for electricity demand. These analyses are also conducted at the level of each DNO's area of operation.

6.2. DNO regions

For the purpose of this study, Ofgem requested that all forecasts of electricity demand drivers and MPANs are made for the regions relevant to each DNO. However, since data such as employment levels and dwelling completions are complied for standard statistical or administrative regions, a conversion must be made to estimate the levels of these factors in each of what we call the DNO regions. In order to do so, we were provided by Ofgem with a list of the postcodes matching the areas of operation of each DNO. We then utilised the ONS' National Statistics Postcode Directory to match each postcode with a Local Authority District or Unitary Authority – the smallest geographical area for which there is robust employment and housing data. We then calculate an estimated total for each DNO region by summing up the figures for all the relevant districts. The approach is not perfect as some DNOs share postcodes and because the overlap between certain postcodes and districts is not exact. However, we expect these issues to have a limited net effect once the district level figures are summed up for each DNO, and hence there should not be any systematic bias in the estimates.

6.3. Employment

Substantial changes in the macroeconomic environment are often accompanied by corresponding developments in the labour market. In the case of recessions, weaker demand prompts businesses to cut their costs. Since, as we discuss in Workstream 1, wages tend to be rather "sticky" downwards and rarely fall enough for firms to maintain profitability at its pre-recession levels, periods of weaker demand tend to exhibit fewer hiring and more redundancies, thus resulting in lower employment levels. In this section we discuss the impact of the current crisis on employment levels in the period to 2014/15 within the context of each of our forecasting scenarios. The premise, as discussed by Oxera is that employment levels can be a reasonable proxy of demand for electricity by industrial and commercial customers.

6.3.1. Methodology

Our approach to forecasting employment levels comprises three main steps:

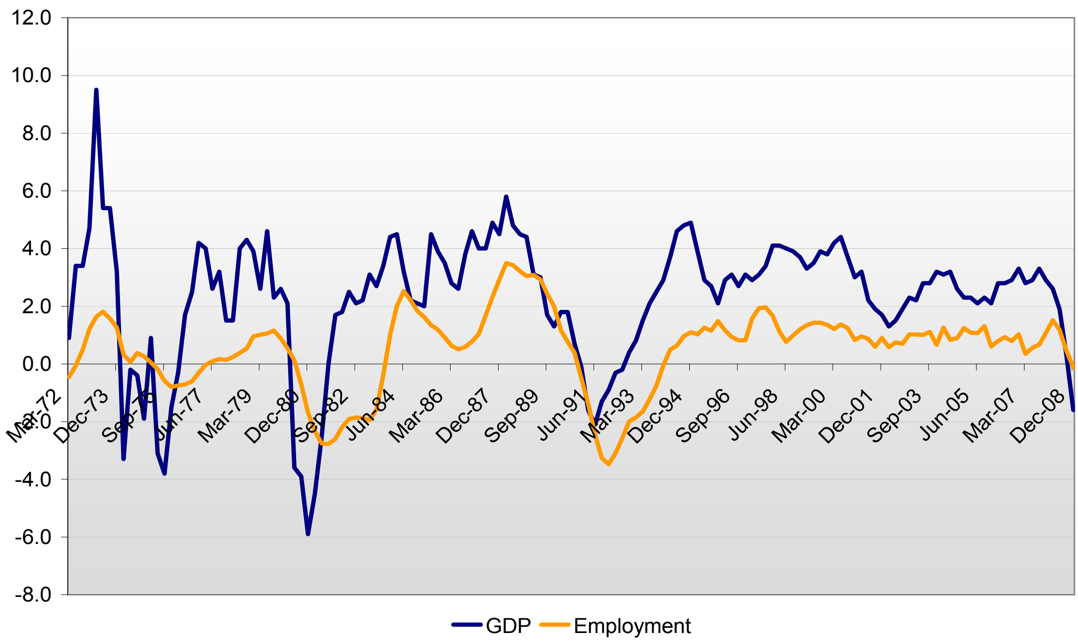
- We begin by observing the historical relationship in the UK between GDP growth and employment growth. We use the observations gained through this exercise to generate employment growth scenarios for the UK as a whole that correspond to our three GDP growth scenarios.
- We then examine the correlation coefficients between employment growth rates in each DNO region and the total employment growth rate for the UK. We use these correlation coefficients and our forecasts mentioned above to come up with three employment growth scenarios for each region.
- Lastly, we apply our employment growth scenarios to the number of people in employment in each DNO region to come up with three trajectories for regional employment levels.

We now turn to discuss each step of our forecasting approach in turn.

6.3.2. Employment growth forecasts for the UK as a whole

As Figure 6.1 shows, the growth rate of employment has tended to lag behind GDP growth by about one year and on the whole has been smaller in magnitude. The former observation is due to the fact that hiring and firing workers is not an instantaneous undertaking. Hiring normally involves a search period for a suitable candidate, while firing, with the exception of extreme cases, involves a delay between the issuance of a redundancy notice and when it comes into effect. As a result, firms tend to wait for evidence of a sustained period of higher or lower demand for their product before making substantial changes to their workforce. We would not expect changes in employment levels to be the same as changes in GDP growth for a range of reasons, including productivity growth.

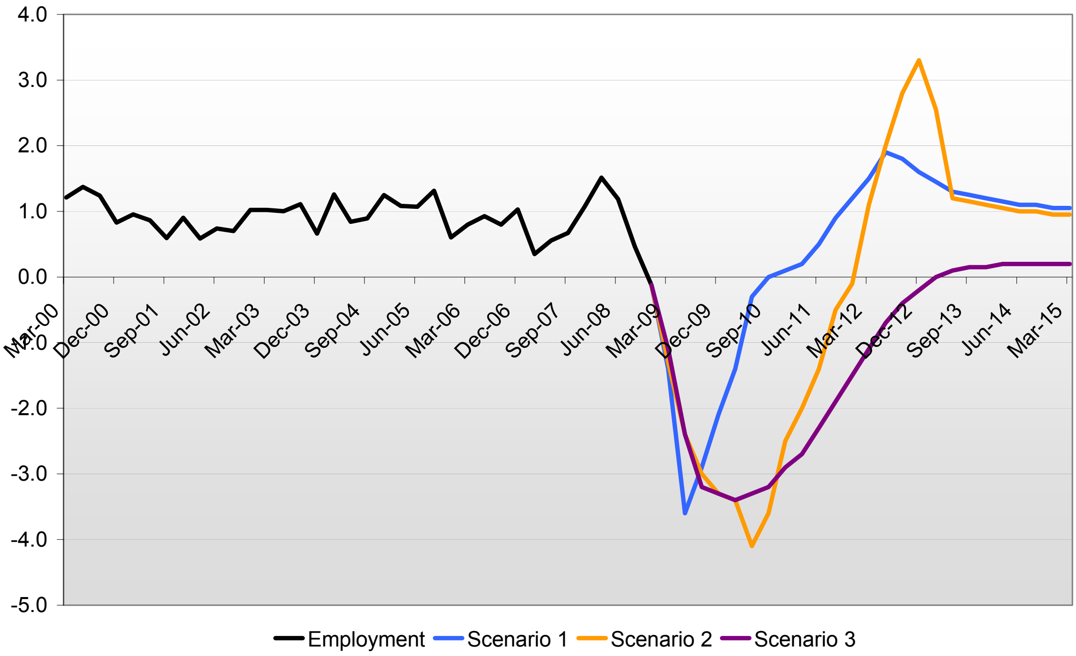
Figure 6.1: GDP and employment growth in the UK



Sources: ONS and CEPA analysis

Based on the above observations, we developed three forecast paths for employment growth based on our three growth scenarios. These are shown in Figure 6.2.

Figure 6.2: Employment growth scenarios



Sources: ONS and CEPA analysis

Table 6.1 summarises our forecasts for employment growth under each of the scenarios. Our GDP growth projections are also repeated in Table 6.1, for ease of reference.

Table 6.1: Employment and GDP growth forecasts (% change year-on-year)

		Employment growth			**GDP growth**		
		Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 1**	**Scenario 2**	**Scenario 3**
2008/9		0.0	0.0	0.0	-3.2	-1.8	-1.8
2009/10		-2.2	-2.7	-2.7	-1.5	-3.5	-3.0
DPCR5	2010/11	0.0	-2.6	-2.6	2.6	-1.3	-2.0
	2011/12	0.9	-0.2	-1.4	3.7	3.7	-1.0
	2012/13	1.4	2.2	-0.3	3.0	2.6	1.0
	2013/14	1.0	0.9	0.1	2.9	2.3	1.4
	2014/15	0.9	0.8	0.2	2.8	2.2	1.4
	Average	*0.9*	*0.2*	*-0.8*	*3.0*	*1.9*	*0.2*
Average for 2008/9-2014/15		*0.3*	*-0.2*	*-1.0*	*1.5*	*0.6*	*-0.6*

Source: CEPA analysis

6.3.3. Employment growth forecasts for DNO regions

As noted above, the next step in our forecasting process is to examine the relationship between the employment growth rate of individual DNO regions and that of the UK as a whole, and to apply this relationship to our forecasts in order to achieve employment growth rate forecasts for each region.

Employment level figures are available for every Local Authority District or Unitary Authority in the UK for the fiscal years 2004/5 to 2007/8 from the ONS's labour market statistics portal Nomis. Clearly a time series with only four entries for each district is too short for us to be able to conduct any meaningful correlation analysis on. We must, therefore, artificially extend the series into the past. To do that, we calculate the share of each district's employment level in the total employment level of the Government Office Region (GOR) to which the district belongs in each of the four years for which we have district-level data. Employment data for GORs stretches back to 1992/3, so by assuming that each district's share of employment in its GOR is constant over time (which we acknowledge is by no means a certainty), we are able to generate a time series of district employment levels going back 15 years. After summing up the employment levels in the relevant districts for each DNO, we calculate the growth rate of employment in each DNO region. Table 6.2 presents the contemporaneous correlation coefficients between the employment growth rate of each of the 14 DNO regions and the employment growth rate for the UK as a whole.

Table 6.2: Employment growth – correlation coefficients between DNO regions and the UK average (1993/4-2007/8)

Region	Correlation coefficient with UK average
SSE Hydro	0.12
SSE Southern	0.50
SP Distribution	0.27
SP Manweb	0.21
CE NEDL	0.33
CE YEDL	0.32
ENW	0.26
CN East	0.31
CN West	0.02
WPD South Wales	-0.02
WPD South West	0.38
EDF EPN	0.69
EDF LPN	0.70
EDF SPN	0.34

Sources: ONS Nomis and CEPA analysis

As can be seen from the table, the regions covered by EDF (especially LPN and EPN) have had the strongest relationship with employment growth since 1993/4. This is not surprising since during this period the service industry has become an increasingly dominant employer and the main source of value creation in the UK economy. Many of the leading growth industries during this period, such as information technology and financial services, are largely based in those parts of the UK.

In contrast, Table 6.2 also shows that South Wales and the region covered by Central Networks West share a very low, essentially zero, correlation coefficient with the UK average. This indicates that job mix in these regions is notably different from the rest of the UK. It may also indicate that residents of these regions move to other regions (most likely London and its surrounding areas) during periods of good general performance by the UK economy, such as typified the period under consideration in our data set.

6.3.4. Employment level forecasts for DNO regions

The third and final step in our approach to forecasting is to convert the growth estimates to figures for employment levels. Our base year for making these forecasts is 2007/8, the last financial year for which there is a complete set of outturn employment numbers. Tables 6.3, 6.4 and 6.5 present our results for scenarios 1, 2 and 3, respectively.

Table 6.3: Employment level forecasts for scenario 1 (thousands)

		SSE Hydro	**SSE South**	**SP Dist**	**SP Man**	**CE NEDL**	**CE YEDL**	**ENW**	**CN East**	**CN West**	**WPD SWales**	**WPD SWest**	**EDF EPN**	**EDF LPN**	**EDF SPN**	**Total**
2008/9		1,169	2,471	1,165	1,304	1,227	2,180	2,183	1,818	2,354	975	1,503	2,668	3,903	1,779	26,700
2009/10		1,163	2,435	1,152	1,288	1,193	2,134	2,154	1,788	2,365	984	1,487	2,571	3,632	1,742	26,091
DPCR5	2010/11	1,166	2,437	1,153	1,290	1,191	2,135	2,157	1,793	2,380	992	1,493	2,563	3,600	1,740	26,088
	2011/12	1,172	2,455	1,159	1,298	1,200	2,154	2,172	1,812	2,395	1,000	1,507	2,589	3,657	1,750	26,321
	2012/13	1,181	2,483	1,168	1,312	1,218	2,186	2,196	1,841	2,411	1,007	1,527	2,639	3,773	1,770	26,711
	2013/14	1,188	2,505	1,175	1,322	1,230	2,210	2,214	1,863	2,427	1,014	1,543	2,673	3,851	1,784	26,999
	2014/15	1,194	2,524	1,181	1,331	1,241	2,231	2,230	1,884	2,443	1,021	1,558	2,703	3,917	1,795	27,253
	Average	*1,180*	*2,481*	*1,167*	*1,310*	*1,216*	*2,183*	*2,194*	*1,839*	*2,411*	*1,007*	*1,525*	*2,633*	*3,760*	*1,768*	*26,674*
Average for 2008/9-2014/15		*1,176*	*2,473*	*1,165*	*1,306*	*1,214*	*2,176*	*2,187*	*1,828*	*2,396*	*999*	*1,517*	*2,629*	*3,762*	*1,766*	*26,595*

Source: CEPA analysis

Table 6.4: Employment level forecasts for scenario 2 (thousands)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		1,169	2,471	1,165	1,304	1,227	2,180	2,183	1,818	2,354	975	1,503	2,668	3,903	1,779	26,700
2009/10		1,161	2,427	1,149	1,285	1,187	2,124	2,148	1,781	2,365	985	1,483	2,552	3,583	1,735	25,965
DPCR5	2010/11	1,153	2,383	1,133	1,266	1,147	2,070	2,112	1,745	2,376	994	1,463	2,440	3,286	1,693	25,262
	2011/12	1,155	2,382	1,133	1,266	1,142	2,066	2,112	1,746	2,390	1,002	1,466	2,425	3,239	1,687	25,212
	2012/13	1,167	2,424	1,147	1,285	1,170	2,114	2,147	1,787	2,407	1,009	1,494	2,503	3,419	1,719	25,791
	2013/14	1,174	2,443	1,153	1,294	1,181	2,135	2,164	1,807	2,423	1,016	1,509	2,533	3,481	1,730	26,043
	2014/15	1,180	2,460	1,159	1,302	1,190	2,153	2,178	1,826	2,438	1,024	1,523	2,557	3,532	1,741	26,264
	Average	*1,166*	*2,418*	*1,145*	*1,283*	*1,166*	*2,108*	*2,143*	*1,782*	*2,407*	*1,009*	*1,491*	*2,492*	*3,391*	*1,714*	*25,714*
Average for 2008/9-2014/15		*1,166*	*2,427*	*1,149*	*1,286*	*1,178*	*2,120*	*2,149*	*1,787*	*2,393*	*1,001*	*1,491*	*2,526*	*3,492*	*1,726*	*25,891*

Source: CEPA analysis

Table 6.5: Employment level forecasts for scenario 3 (thousands)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		1,169	2,471	1,165	1,304	1,227	2,180	2,183	1,818	2,354	975	1,503	2,668	3,903	1,779	26,700
2009/10		1,161	2,426	1,149	1,284	1,186	2,123	2,147	1,780	2,365	985	1,482	2,550	3,578	1,735	25,952
DPCR5	2010/11	1,153	2,382	1,133	1,265	1,147	2,069	2,112	1,744	2,376	994	1,463	2,440	3,284	1,692	25,256
	2011/12	1,150	2,360	1,125	1,256	1,124	2,040	2,094	1,727	2,388	1,003	1,454	2,377	3,120	1,668	24,885
	2012/13	1,152	2,357	1,123	1,255	1,118	2,035	2,092	1,727	2,402	1,012	1,457	2,359	3,067	1,661	24,817
	2013/14	1,155	2,362	1,124	1,258	1,117	2,038	2,097	1,734	2,417	1,020	1,463	2,356	3,051	1,661	24,851
	2014/15	1,158	2,367	1,126	1,260	1,117	2,042	2,101	1,742	2,432	1,028	1,471	2,354	3,039	1,661	24,896
	Average	*1,154*	*2,366*	*1,126*	*1,259*	*1,125*	*2,045*	*2,099*	*1,735*	*2,403*	*1,011*	*1,462*	*2,377*	*3,112*	*1,669*	*24,941*
Average for 2008/9-2014/15		*1,157*	*2,389*	*1,135*	*1,269*	*1,148*	*2,075*	*2,118*	*1,753*	*2,391*	*1,002*	*1,470*	*2,443*	*3,292*	*1,694*	*25,337*

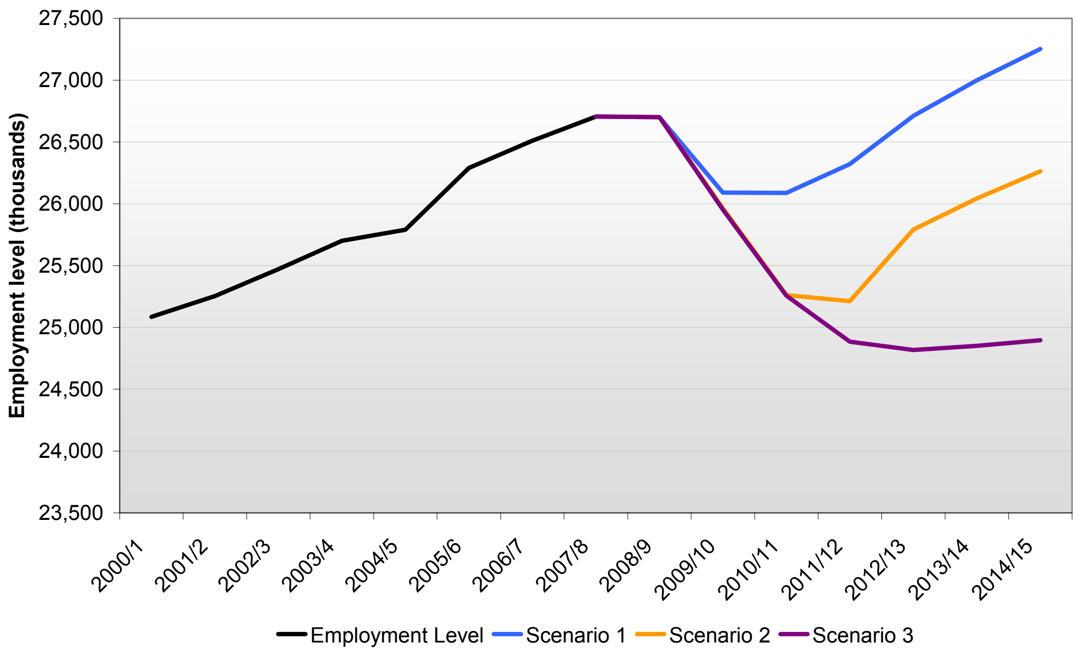
Source: CEPA analysis

The tables highlight the fact that employment is likely to be worse hit in those regions where it has been most buoyant during the boom years, namely London and its surrounding areas. Taking a step back from the numbers provided above, it is intuitive to expect that these regions would be worse affected in employment terms than other parts of the country since the origin of the current crisis is in the financial services sector. As businesses in that sector are forced to close down or substantially downsize, the impact would feed through to other sectors in the region, such as retail, entertainment, catering and hotels.

In contrast, the regions covered by WPD South Wales and CN West are forecast to suffer the least from the current crisis and may, in fact, see better performance of the labour market the worse the crisis becomes. While this may not seem intuitive at first, it can be explained by the fact that the economic sector mix in these regions is different from other regions and, as a result, the region can be expected to be less adversely affected by the current crisis. Furthermore, the worse the crisis gets, the greater is the likelihood that some of the people who moved out of these regions to London and its surrounding areas during the boom years will return as they lose their jobs or lose confidence in job prospects in their adopted regions.

The final column in tables 6.3, 6.4 and 6.5 presents the impact on the overall level of employment. The vast difference in outcomes for the UK economy under our three chosen scenarios is illustrated by the fact that there is an average difference of around one million employed persons during DPCR5 between scenario 1 and scenario 2 and an average difference of eight hundred thousand employed persons between scenario 2 and scenario 3. The path of overall employment under the three scenarios is illustrated in Figure 6.3.

Figure 6.3: Employment level scenarios



Sources: ONS Nomis and CEPA analysis

6.4. New connections

In this section we utilise our scenarios to forecast developments in the real estate sector in order to come up with estimates for the number of new electricity connections during the period to 2014/15 and in order to consider how this outlook might be affected by the economic situation. We split our analysis into two parts – residential connections and commercial and industrial connections.

6.4.1. Residential connections

Methodology

We use the Department for Communities and Local Government's (DCLG's) dwelling completions series, which is available on a Local Authority District and Unitary Authority basis for every financial year since 1999/2000, in order to come up with forecasts for the number of new residential connections in each year up to and including 2014/15. The rationale here is that a new dwelling can be expected to have its own meter and represent a single new connection (that is, we are assuming a one-to-one relationship between the number of dwellings and the number of residential connections).[38] Therefore, assuming a reasonable estimate for average demand per residential connection, it is possible to forecast electricity demand for residential premises.

Table 6.6 presents the contemporaneous correlation coefficients between dwelling completions and employment levels in each region, as well as between dwelling completions in each region and the UK-wide GDP growth rate. It is clear from the table that dwelling completions share a stronger correlation coefficient with employment level than with GDP growth.[39] We believe this is, first, because employment statistics are available on a regional basis, thus accounting for the particular characteristics and economic performance of each geographical region, and second, because both employment levels and property development are driven by the same two main factors – namely the size of the population in the region and the level of economic activity.

[38] This is likely to be a broadly reasonable assumption, although there may be some circumstances where one meter serves multiple residences, e.g. a block of flats with a single landlord.

[39] The results are not significantly different if the level of real GDP is used instead of the growth rate of GDP.

Table 6.6: Correlation coefficients between dwelling completions and employment levels (1999/2000-2007/8)

Region	Correlation coefficient with employment level	Correlation coefficient with GDP growth
SSE Hydro	-0.80	0.65
SSE Southern	0.96	-0.34
SP Distribution	-0.24	-0.36
SP Manweb	0.62	0.10
CE NEDL	0.73	-0.28
CE YEDL	0.92	-0.26
ENW	0.41	-0.41
CN East	0.82	-0.05
CN West	0.05	0.61
WPD South Wales	0.40	0.11
WPD South West	0.62	-0.41
EDF EPN	0.74	-0.21
EDF LPN	0.58	-0.40
EDF SPN	0.86	-0.45

Sources: ONS Nomis, DCLG and CEPA analysis

As the table shows, there is a strong correlation coefficient between dwelling completions and employment levels for nearly all regions (ten out of 14 have a correlation coefficient absolute value that is greater than 0.5). The weakest correlation coefficients were found for Central Networks West and Scottish Power Distribution. In both cases, the regional labour market has not performed strongly during the boom years, but the level of new development has remained robust owing to urban regeneration schemes in the major cities. As in other sections, the main concern we have with the above figures is the small sample size available (nine years for each region).

New residential connections forecasts for DNO regions

Based on the correlation coefficients presented in Table 6.6, we made forecasts on the number of dwelling completions in each of the 14 DNO regions and for each of our three scenarios. The results are presented in Tables 6.7, 6.8 and 6.9.

Table 6.7: Dwelling completions forecasts for scenario 1 (units)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		11,165	20,107	12,984	8,564	8,442	14,946	12,965	15,849	13,856	6,749	9,746	23,571	19,463	11,712	190,117
2009/10		11,336	18,297	13,078	8,342	7,884	14,454	12,743	15,111	13,870	6,779	9,608	20,138	14,756	10,442	176,817
DPCR5	2010/11	11,263	18,419	13,075	8,364	7,838	14,461	12,763	15,237	13,888	6,806	9,657	19,845	14,191	10,326	176,133
	2011/12	11,089	19,323	13,033	8,485	7,994	14,669	12,880	15,715	13,907	6,830	9,783	20,786	15,182	10,709	180,386
	2012/13	10,750	20,744	12,965	8,672	8,284	15,009	13,063	16,427	13,928	6,854	9,960	22,542	17,206	11,405	187,907
	2013/14	10,654	21,821	12,914	8,815	8,485	15,262	13,202	16,987	13,947	6,878	10,104	23,758	18,561	11,889	193,278
	2014/15	10,472	22,790	12,869	8,944	8,657	15,487	13,327	17,502	13,967	6,903	10,238	24,803	19,702	12,305	197,967
	Average	*10,866*	*20,619*	*12,971*	*8,656*	*8,252*	*14,978*	*13,047*	*16,374*	*13,927*	*6,854*	*9,948*	*22,347*	*16,968*	*11,327*	*187,134*
Average for 2008/9-2014/15		*10,976*	*20,214*	*12,988*	*8,598*	*8,226*	*14,898*	*12,992*	*16,118*	*13,909*	*6,829*	*9,871*	*22,206*	*17,009*	*11,252*	*186,087*

Source: CEPA analysis

Table 6.8: Dwelling completions forecasts for scenario 2 (units)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		11,165	20,107	12,984	8,564	8,442	14,946	12,965	15,849	13,856	6,749	9,746	23,571	19,463	11,712	190,117
2009/10		11,388	17,890	13,099	8,291	7,777	14,349	12,692	14,928	13,870	6,780	9,568	19,480	13,895	10,171	174,179
DPCR5	2010/11	11,612	15,695	13,213	8,019	7,128	13,762	12,422	14,018	13,883	6,813	9,391	15,537	8,747	8,656	158,897
	2011/12	11,561	15,647	13,219	8,020	7,041	13,726	12,420	14,067	13,901	6,840	9,422	15,002	7,925	8,461	157,252
	2012/13	11,230	17,752	13,115	8,294	7,502	14,238	12,688	15,078	13,923	6,861	9,667	17,756	11,045	9,573	168,722
	2013/14	11,047	18,727	13,069	8,424	7,676	14,463	12,815	15,588	13,942	6,886	9,800	18,793	12,130	9,997	173,356
	2014/15	11,877	19,596	13,029	8,541	7,821	14,661	12,928	16,052	13,962	6,911	9,924	19,663	13,014	10,355	177,333
	Average	*11,265*	*17,483*	*13,129*	*8,260*	*7,434*	*14,170*	*12,654*	*14,960*	*13,922*	*6,862*	*9,641*	*17,350*	*10,572*	*9,409*	*167,112*
Average for 2008/9-2014/15		*11,269*	*17,916*	*13,104*	*8,308*	*7,627*	*14,306*	*12,704*	*15,083*	*13,905*	*6,834*	*9,645*	*18,543*	*12,317*	*9,847*	*171,408*

Source: CEPA analysis

Table 6.9: Dwelling completions forecasts for scenario 3 (units)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		11,165	20,107	12,984	8,564	8,442	14,946	12,965	15,849	13,856	6,749	9,746	23,571	19,463	11,712	190,117
2009/10		11,393	17,852	13,101	8,286	7,766	14,339	12,687	14,911	13,870	6,781	9,564	19,418	13,813	10,147	173,928
DPCR5	2010/11	11,614	15,676	13,214	8,017	7,124	13,757	12,419	14,010	13,883	6,813	9,389	15,507	8,709	8,645	158,777
	2011/12	11,706	14,527	13,275	7,878	6,755	13,442	12,279	13,567	13,899	6,843	9,312	13,284	5,853	7,780	150,401
	2012/13	11,665	14,406	13,285	7,869	6,650	13,388	12,268	13,582	13,917	6,870	9,337	12,651	4,942	7,543	148,373
	2013/14	11,578	14,635	13,276	7,904	6,635	13,423	12,301	13,754	13,935	6,897	9,396	12,549	4,658	7,519	148,460
	2014/15	11,486	14,901	13,266	7,945	6,628	13,467	12,339	13,943	13,953	6,924	9,459	12,502	4,440	7,516	148,770
	Average	*11,610*	*14,829*	*13,263*	*7,922*	*6,758*	*13,495*	*12,321*	*13,771*	*13,918*	*6,869*	*9,379*	*13,299*	*5,721*	*7,801*	*150,956*
Average for 2008/9-2014/15		*11,515*	*16,015*	*13,200*	*8,066*	*7,143*	*13,823*	*12,466*	*14,231*	*13,902*	*6,839*	*9,458*	*15,640*	*8,840*	*8,695*	*159,832*

Source: CEPA analysis

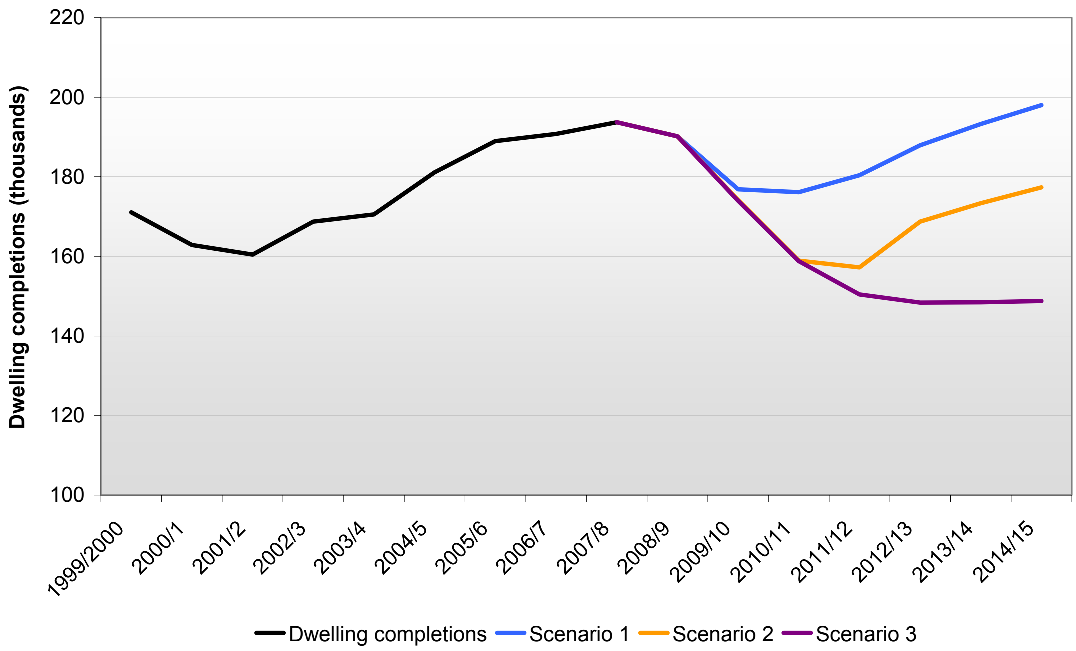
The first thing to note from the tables is that, since our forecasts for dwellings completions feed off our employment level forecasts, the overall pattern in the former set of forecasts resembles that of the latter in the sense that those regions which are expected to be worst hit by the crisis are also expected to see the largest declines in new dwelling completions. This is easy to justify since weak economic performance and lower employment levels would lead to migration out of a region and reduce housing demand. At the same time, the stock of existing unoccupied dwellings would increase, eating into the incentive to invest in new construction.

Secondly, dwelling completions decline as the economic situation worsens (that is, moving from scenario 1 to 2 and 3). In addition to the factors outlined above, the longer and/ or deeper the current recession becomes, the more likely it is that certain construction companies would have to close down, thus further impacting dwelling completions.

Our forecasts see the regions distributed by WPD South Wales and Central Networks West performing better the worse the crisis becomes. Once again this relates to our expectation that there will be some return migration the longer and deeper the recession is, as some of the people who moved out of these regions during the boom years are likely to return as the labour market in their adopted region worsens.

The final column in tables 6.7, 6.8 and 6.9 presents the impact on the overall level of dwelling completions. The vast difference in outcomes for the UK economy under our three chosen scenarios is illustrated by the fact that the average number of dwelling completions during DPCR5 is around 20,000 lower in scenario 2 compared to scenario 1, and a further 17,000 lower in scenario 3 compared to scenario 2. Figure 6.4 illustrates the total number of new dwellings under our three scenarios.

Figure 6.4: Dwelling completions scenarios



Sources: DCLG and CEPA analysis

6.4.2. Commercial and industrial connections

Methodology

Forecasting commercial and industrial connections is extremely difficult owing to the fact that there is no publicly-available historical series on the number of properties in either category, and certainly no such data at the level of disaggregation necessary for our study.[40] Furthermore, in order to translate forecasts of commercial and industrial connections into electricity demand effects, an understanding of likely average consumption values would be required. In order to come up with forecasts, therefore, we must make several assumptions along the way. The approach we undertake to forecasting new industrial and commercial connections is as follows:

- We use the BERR/ONS series of construction sector output as our starting point. This series provides quarterly data for the UK as a whole on the real value of construction sector output dating back to 1955 and includes figures of the *value*[41] of new private commercial property and new private industrial property.
- We compute the year-on-year growth rate in the value of each category and note the correlation coefficient with UK-wide employment growth.
- Based on our three scenarios for employment growth, we forecast three scenarios for the growth rate of industrial and commercial property value. From this we calculate the total value of new industrial property and of new commercial property for each financial year from 2008/9 to 2014/15.

While clearly not an ideal measure, the growth rate derived here would correspond to the growth rate of new connections if the value measure was steady over time. Owing to the lack of any indicators of industrial and commercial property at the district or region-level, we are not able to provide forecasts for each DNO region.

Commercial and industrial connections forecasts

We note that the growth rate of new industrial property value has shared a contemporaneous correlation coefficient of 0.59 with the growth rate of UK-wide employment growth over the period 1971/2 – 2007/8, and that new commercial property value has shared a correlation coefficient of 0.43 with UK-wide employment growth over the same time period. Figures 6.5 and 6.6 present our growth scenarios for new industrial and commercial property values, respectively.

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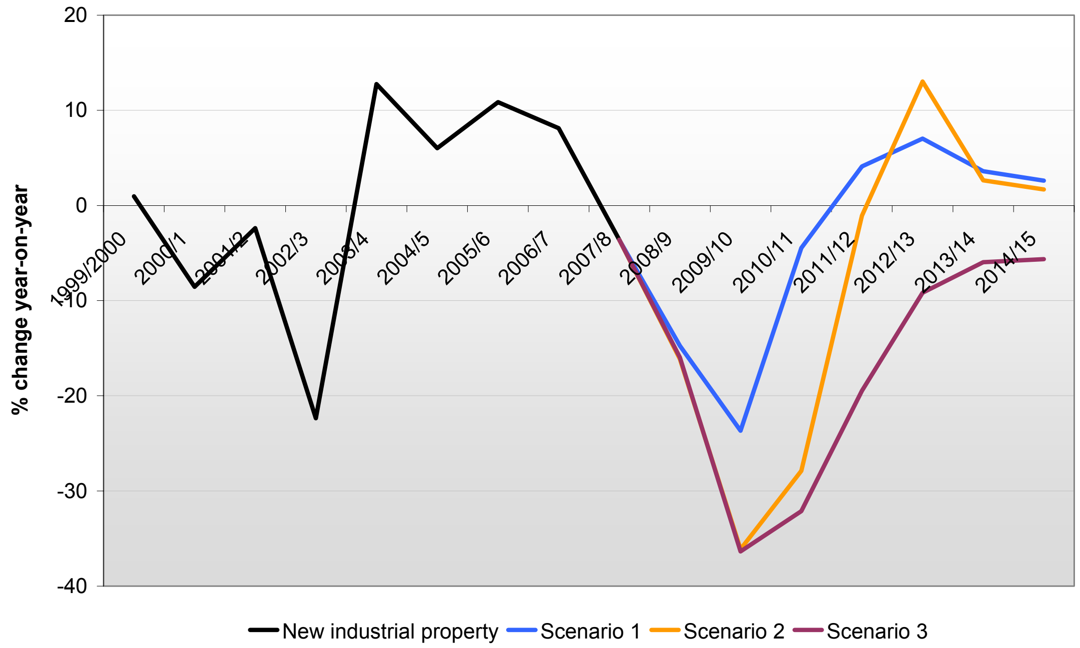
[40] Indeed, we note that Oxera does not attempt to forecast commercial and industrial MPANs in either its August 2007 or November 2008 papers.

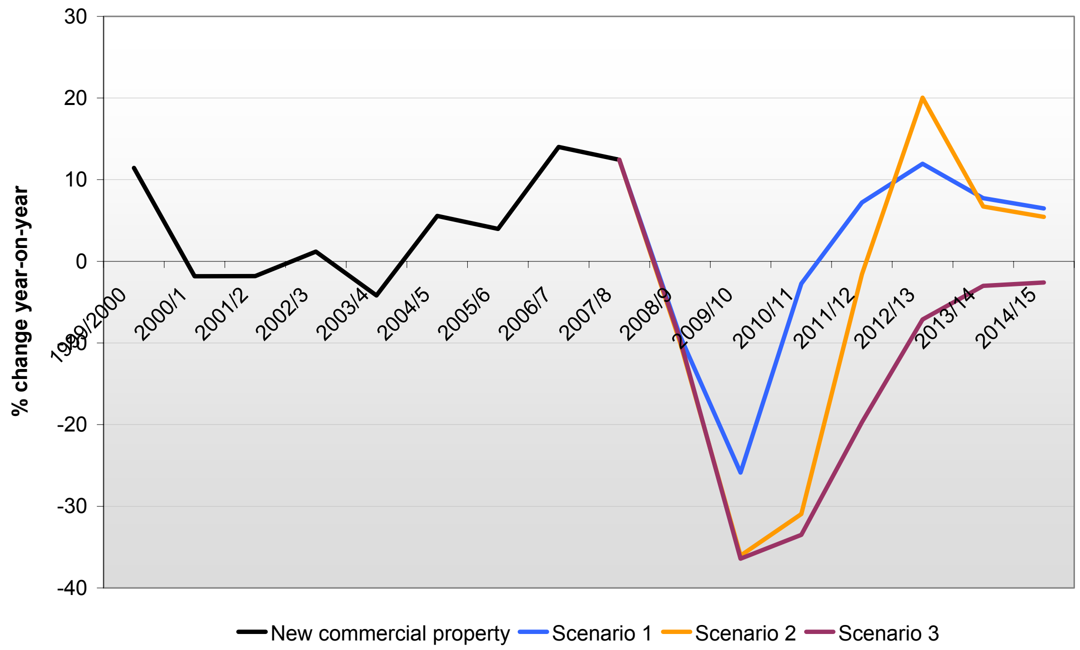
[41] According to the ONS, "value" here means:
- building, civil engineering and associated work done by the contractor's directly employed staff;
- materials used, labour costs, overheads and profits;
- work done on the contractor's own initiative on buildings such as dwellings for eventual sale or lease;
- work done on demolition and site preparation;
- work done by the contractor on the construction or maintenance of its own premises;
- articles made by the contractor and used in construction work; and
- any materials supplied by the contractor free of charge to subcontractors.

Figure 6.5: Industrial property growth scenarios



Sources: BERR/ONS and CEPA analysis

Figure 6.6: Commercial property growth scenarios



Sources: BERR/ONS and CEPA analysis

Table 6.10 presents the growth forecasts for new industrial and commercial connections under each of our three scenarios. As the table shows, and as noted elsewhere in this report, our scenarios represent a wide range of plausible outcomes for the industrial and commercial property over the period to 2014/15, which reiterates the degree of uncertainty that currently prevails about future macroeconomic developments.

Table 6.10: New industrial and commercial connections growth rates (% year-on-year)

		Industrial property			Commercial property		
		Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 1**	**Scenario 2**	**Scenario 3**
2008/9		-14.7	-16.1	-16.0	-9.1	-9.9	-9.5
2009/10		-23.7	-36.1	-36.4	-25.9	-36.0	-36.4
DPCR5	2010/11	-4.5	-27.9	-32.1	-2.7	-30.9	-33.5
	2011/12	4.1	-1.1	-19.5	7.2	-1.6	-19.7
	2012/13	7.0	13.0	-9.2	12.0	20.0	-7.1
	2013/14	3.6	2.7	-6.0	7.8	6.7	-3.0
	2014/15	2.6	1.8	-5.6	6.5	5.4	-2.6
	Average	*2.6*	*-2.3*	*-14.5*	*6.1*	*-0.1*	*-13.2*
Average for 2008/9-2014/15		*-3.7*	*-9.1*	*-17.8*	*-0.6*	*-6.6*	*-16.0*

Source: CEPA analysis

6.4.3. Conclusions for new connections

This section presented forecasts for the number of new connections in the period to 2014/15 based on the outlook for new dwelling completions, and forecasts of new connections growth rates in the industrial and commercial sectors based on our own forecasts of employment growth. As a sense check against our results, we note the Royal Chartered Institute of Surveyors' (RICS) latest survey of the construction sector[42], which stated that the fall in workload during the final three months of 2008 was the sharpest in the survey's history, with workloads for private housing, private commercial, private industrial and infrastructure falling to their lowest levels on record, while public housing workloads improved marginally from their record low in the previous quarter. It is worth noting public projects, which are less likely to be affected by the crisis and could, therefore, be seen to provide a fixed minimum level of new connections that is almost independent of future macroeconomic developments.

6.5. Drivers of electricity demand

Having made forecasts on economic growth (in Section 2) and the levels of employment, Ofgem asked us to consider the relationship between these factors and electricity demand. Table 6.11 presents the contemporaneous correlation coefficient for each DNO region between total electricity distributed (LV, HV and EHV) and three drivers of demand – GDP, employment levels and the population size of the region.

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[42] 'RICS construction market survey – United Kingdom', fourth quarter 2008.

Table 6.11: Correlation coefficients between total electricity units distributed and its drivers (1992/3-2007/8)

Region	GDP	Employment level	Population level
SSE Hydro	0.98	0.82	-0.64
SSE Southern	0.99	0.99	0.98
SP Distribution	0.95	0.70	0.85
SP Manweb	0.23	-0.21	0.00
CE NEDL	0.96	0.82	-0.69
CE YEDL	0.95	0.89	0.84
ENW	0.99	0.95	0.61
CN East	1.00	0.98	0.97
CN West	0.97	0.97	0.88
WPD South Wales	0.98	0.87	0.89
WPD South West	1.00	0.98	0.97
EDF EPN	0.99	0.98	0.99
EDF LPN	0.98	0.97	0.99
EDF SPN	0.97	0.96	0.97
Average	*0.93*	*0.83*	*0.61*

Source: Ofgem, ONS Nomis and CEPA analysis

The correlation coefficient of GDP and employment levels with total units of electricity distributed are both very strong, with the correlation coefficient for GDP being stronger than for employment levels. The correlation coefficient for population level is also relatively strong. The correlation coefficients for employment levels for Scottish Power Manweb and for population levels for SSE Hydro and CE NEDL are substantial outliers to the overall correlation coefficients.

Table 6.12 exhibits the contemporaneous correlation coefficient in each DNO region between peak electricity demand (total MW) and GDP, employment levels and population levels.

Table 6.12: Correlation coefficients between peak electricity demand and its drivers (1994/5-2007/8)

Region	GDP	Employment level	Population level
SSE Hydro	0.92	0.94	-0.21
SSE Southern	0.89	0.91	0.89
SP Distribution	0.98	0.93	0.93
SP Manweb	0.78	0.73	-0.68
CE NEDL	0.99	0.94	-0.32
CE YEDL	0.95	0.97	0.96
ENW	0.90	0.92	0.84
CN East	0.97	0.96	0.90
CN West	0.97	0.97	0.98
WPD South Wales	0.90	0.96	0.96
WPD South West	0.97	0.96	0.94
EDF EPN	0.50	0.46	0.51
EDF LPN	0.85	0.88	0.86
EDF SPN	0.86	0.81	0.85
Average	*0.89*	*0.88*	*0.60*

Source: Ofgem, ONS Nomis and CEPA analysis

On the whole, the correlation coefficients for peak demand echo those observed for total units distributed, with GDP and employment holding the strongest positive correlation coefficients and population levels also being closely correlated with electricity demand. Compared to the correlation coefficients for total electricity demand the difference between the correlation coefficients for GDP and employment for peak demand is much smaller. Three DNOs have negative correlation coefficients between population and peak electricity demand.

6.5.1. Future level of electricity demand

For this study we have not developed a detailed econometric model to forecast the future level of electricity demand for each DNO. This would be a substantial analytical exercise, and would probably initially need to draw on DNOs' own forecasting models. For example, DNOs would be aware of particularly large new connections in the future or large loads that may come off the system in the future. Furthermore, the current macroeconomic downturn has included major manufacturing companies adopting a range of approaches that are difficult to capture in overall demand forecasts, such as suspending production for periods of time or shorter working weeks. However, from the analysis carried out above, and building on the correlation coefficients, it is possible to provide an indicative view of the direction and magnitude of changes to electricity demand that might occur under the three scenarios. To do this we have used the correlation between total electricity demand and GDP, and peak electricity demand and GDP. Tables 6.13 to 6.15 shows the indicative forecasts for the trends in total electricity demand under each of the scenarios. The indicative average demand for all DNOs for each of EDPCR5 has a variation of about 10,000 across the three scenarios. Consistent with the forecasts for economic growth under each scenario, scenario one has the highest indicative demand forecast and scenario three has the lowest.

Table 6.13: Indicative forecasts for total electricity demand for scenario one (GWh)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		8,900	35,636	23,158	17,551	17,579	25,183	26,826	30,668	28,491	13,380	16,349	38,681	29,553	21,927	333,884
2009/10		8,844	35,227	23,057	17,527	17,439	25,037	26,598	30,359	28,273	13,272	16,186	38,260	29,117	21,766	330,962
DPCR5	2010/11	8,941	35,936	23,233	17,569	17,681	25,291	26,993	30,895	28,651	13,460	16,468	38,991	29,874	22,044	336,026
	2011/12	9,086	37,002	23,497	17,632	18,004	25,673	27,588	31,701	29,218	13,742	16,891	40,089	31,011	22,463	343,637
	2012/13	9,206	37,889	23,717	17,684	18,347	25,991	28,083	32,372	29,691	13,977	17,243	41,003	31,959	22,811	349,974
	2013/14	9,325	38,761	23,933	17,736	18,644	26,304	28,569	33,031	30,155	14,208	17,589	41,902	32,890	23,153	356,202
	2014/15	9,444	39,639	24,151	17,788	18,943	26,619	29,059	33,695	30,622	14,441	17,938	42,806	33,827	23,498	362,469
	Average	*9,106*	*37,156*	*23,535*	*17,641*	*18,097*	*25,728*	*27,674*	*31,817*	*29,300*	*13,783*	*16,952*	*40,247*	*31,176*	*22,523*	*349,661*
Average for 2008/9-2014/15		*9,200*	*37,846*	*23,706*	*17,682*	*18,332*	*25,976*	*28,058*	*32,339*	*29,667*	*13,966*	*17,226*	*40,958*	*31,912*	*22,794*	*344,736*

Source: CEPA analysis

Table 6.14: Indicative forecasts for total electricity demand for scenario two (GWh)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		8,957	36,059	23,263	17,576	17,723	25,335	27,062	30,988	28,716	13,492	16,516	39,117	30,005	22,093	336,902
2009/10		8,822	35,064	23,016	17,517	17,384	24,978	26,507	30,235	28,186	13,229	16,121	38,091	28,942	21,702	329,795
DPCR5	2010/11	8,772	34,698	22,926	17,496	17,259	24,847	26,303	29,958	27,991	13,132	15,976	37,714	28,551	21,558	327,180
	2011/12	8,910	35,714	23,178	17,556	17,605	25,211	26,869	30,726	28,532	13,401	16,379	38,761	29,636	21,957	334,436
	2012/13	9,009	36,442	23,358	17,599	17,853	25,472	27,276	31,277	28,920	13,594	16,669	39,512	30,414	22,243	339,638
	2013/14	9,101	37,117	23,525	17,639	18,083	25,714	27,652	31,788	29,279	13,773	16,936	40,207	31,134	22,508	344,457
	2014/15	9,190	37,770	23,687	17,677	18,306	25,949	28,016	32,282	29,627	13,946	17,196	40,880	31,832	22,764	349,122
	Average	*8,966*	*36,123*	*23,279*	*17,580*	*17,745*	*25,358*	*27,098*	*31,036*	*28,750*	*13,509*	*16,542*	*39,183*	*30,073*	*22,118*	*338,966*
Average for 2008/9-2014/15		*8,997*	*36,348*	*23,335*	*17,593*	*17,821*	*25,439*	*27,223*	*31,206*	*28,870*	*13,569*	*16,631*	*39,415*	*30,313*	*22,206*	*337,361*

Source: CEPA analysis

Table 6.15: Indicative forecasts for total electricity demand for scenario three (GWh)

		SSE Hydro	**SSE South**	**SP Dist**	**SP Man**	**CE NEDL**	**CE YEDL**	**ENW**	**CN East**	**CN West**	**WPD SWales**	**WPD SWest**	**EDF EPN**	**EDF LPN**	**EDF SPN**	**Total**
2008/9		8,957	36,059	23,263	17,576	17,723	25,335	27,062	30,988	28,716	13,492	16,516	39,117	30,005	22,093	336,902
2009/10		8,841	35,207	23,052	17,526	17,432	25,029	26,587	30,343	28,262	13,267	16,178	38,239	29,095	21,758	330,818
DPCR5	2010/11	8,767	34,659	22,916	17,493	17,245	24,833	26,281	29,928	27,970	13,121	15,960	37,673	28,509	21,543	326,899
	2011/12	8,731	34,393	22,850	17,478	17,155	24,737	26,133	29,728	27,829	13,051	15,855	37,400	28,226	21,438	325,002
	2012/13	8,767	34,663	22,917	17,494	17,247	24,834	26,283	29,932	27,972	13,123	15,962	37,678	28,514	21,544	326,929
	2013/14	8,817	35,030	23,008	17,515	17,372	24,966	26,488	30,210	28,168	13,220	16,108	38,057	28,906	21,689	329,555
	2014/15	8,870	35,417	23,104	17,538	17,504	25,105	26,704	30,502	28,374	13,322	16,261	38,455	29,319	21,840	332,315
	Average	8,822	35,061	23,016	17,517	17,383	24,977	26,505	30,233	28,185	13,228	16,120	38,088	28,939	21,701	328,140
Average for 2008/9-2014/15		8,790	34,832	22,959	17,504	17,305	24,895	26,378	30,060	28,063	13,167	16,029	37,853	28,695	21,611	329,774

Source: CEPA analysis

Tables 6.16 to 6.18 show the indicative forecasts for the trends in peak electricity demand under each of the scenarios. On average, there is about a 2,200 spread between the indicative peak demand forecast for scenario one and scenario three. The indicative forecasts of peak demand may be regarded with even more caution that those for total demand because they may be particularly affected by relatively large and peaky new connections or loads ceasing to take supply.

Table 6.16: Indicative forecasts for peak electricity demand for scenario one (MW)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		7,455	6,175	5,670	4,220	2,308	4,752	3,126	6,851	5,634	3,137	4,757	1,695	4,387	3,564	63,730
2009/10		7,376	6,106	5,582	4,203	2,285	4,722	3,095	6,771	5,590	3,098	4,731	1,689	4,372	3,531	63,150
DPCR5	2010/11	7,513	6,226	5,734	4,232	2,324	4,774	3,149	6,909	5,666	3,166	4,777	1,698	4,398	3,588	64,155
	2011/12	7,720	6,407	5,963	4,277	2,384	4,852	3,230	7,115	5,781	3,268	4,845	1,712	4,436	3,675	65,665
	2012/13	7,891	6,557	6,154	4,314	2,433	4,917	3,297	7,288	5,877	3,354	4,902	1,724	4,468	3,747	66,923
	2013/14	8,060	6,705	6,342	4,350	2,482	4,981	3,363	7,457	5,971	3,438	4,958	1,735	4,500	3,817	68,158
	2014/15	8,230	6,854	6,530	4,387	2,531	5,046	3,430	7,627	6,065	3,522	5,014	1,746	4,532	3,888	69,402
	Average	*7,749*	*6,433*	*5,997*	*4,283*	*2,392*	*4,863*	*3,241*	*7,145*	*5,798*	*3,283*	*4,855*	*1,714*	*4,442*	*3,687*	*66,861*
Average for 2008/9-2014/15		*7,883*	*6,550*	*6,145*	*4,312*	*2,431*	*4,914*	*3,294*	*7,279*	*5,872*	*3,350*	*4,899*	*1,723*	*4,467*	*3,743*	*65,883*

Source: CEPA analysis

Table 6.17: Indicative forecasts for peak electricity demand for scenario two (MW)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		7,537	6,247	5,761	4,238	2,331	4,783	3,158	6,933	5,680	3,178	4,784	1,700	4,402	3,598	64,329
2009/10		7,344	6,078	5,547	4,196	2,276	4,710	3,082	6,739	5,572	3,082	4,720	1,687	4,366	3,518	62,919
DPCR5	2010/11	7,273	6,016	5,468	4,181	2,255	4,683	3,055	6,668	5,533	3,047	4,697	1,682	4,353	3,488	62,400
	2011/12	7,470	6,188	5,686	4,223	2,312	4,758	3,132	6,866	5,642	3,145	4,762	1,696	4,390	3,570	63,840
	2012/13	7,611	6,312	5,843	4,253	2,352	4,811	3,187	7,007	5,721	3,215	4,809	1,705	4,416	3,629	64,872
	2013/14	7,742	6,426	5,988	4,282	2,390	4,861	3,238	7,138	5,794	3,280	4,852	1,714	4,440	3,684	65,828
	2014/15	7,868	6,537	6,129	4,309	2,427	4,908	3,288	7,264	5,864	3,342	4,894	1,722	4,464	3,737	66,754
	Average	*7,549*	*6,258*	*5,774*	*4,240*	*2,335*	*4,788*	*3,163*	*6,945*	*5,687*	*3,184*	*4,789*	*1,701*	*4,404*	*3,604*	*64,739*
Average for 2008/9-2014/15		*7,593*	*6,296*	*5,823*	*4,250*	*2,347*	*4,804*	*3,180*	*6,989*	*5,711*	*3,206*	*4,803*	*1,704*	*4,413*	*3,622*	*64,420*

Source: CEPA analysis

Table 6.18: Indicative forecasts for peak electricity demand for scenario three (MW)

		SSE Hydro	SSE South	SP Dist	SP Man	CE NEDL	CE YEDL	ENW	CN East	CN West	WPD SWales	WPD SWest	EDF EPN	EDF LPN	EDF SPN	Total
2008/9		7,537	6,247	5,761	4,238	2,331	4,783	3,158	6,933	5,680	3,178	4,784	1,700	4,402	3,598	64,329
2009/10		7,372	6,103	5,577	4,202	2,284	4,720	3,093	6,767	5,588	3,096	4,730	1,689	4,371	3,529	63,122
DPCR5	2010/11	7,266	6,010	5,459	4,179	2,253	4,680	3,052	6,661	5,529	3,043	4,694	1,682	4,351	3,485	62,344
	2011/12	7,214	5,965	5,402	4,168	2,238	4,661	3,031	6,609	5,500	3,018	4,677	1,679	4,342	3,464	61,968
	2012/13	7,266	6,010	5,460	4,179	2,253	4,680	3,052	6,662	5,529	3,044	4,695	1,682	4,352	3,485	62,350
	2013/14	7,338	6,073	5,539	4,195	2,274	4,707	3,080	6,733	5,569	3,079	4,718	1,687	4,365	3,515	62,871
	2014/15	7,412	6,138	5,623	4,211	2,295	4,736	3,109	6,808	5,610	3,116	4,743	1,692	4,379	3,546	63,419
	Average	*7,344*	*6,078*	*5,546*	*4,196*	*2,275*	*4,710*	*3,082*	*6,739*	*5,572*	*3,082*	*4,720*	*1,687*	*4,366*	*3,518*	*62,590*
Average for 2008/9-2014/15		*7,299*	*6,039*	*5,497*	*4,186*	*2,263*	*4,693*	*3,065*	*6,694*	*5,547*	*3,060*	*4,706*	*1,684*	*4,358*	*3,499*	*62,915*

Source: CEPA analysis

6.6. Summary

In this section we provided forecasts for factors that affect electricity demand – namely employment levels and the number of new residential connections, and the growth rates of new industrial and new commercial connections. In Section 2 we presented our forecasts for another driver of electricity demand – GDP growth. Our forecasts were made within the context of our three forecasting scenarios and were applied to each DNO's region of activity. Table 6.19 summarises the results.

Table 6.19: UK average forecasts over 2010/11 – 2014/15

	GDP growth (% change)	Employment level (thousands)	Residential connections (units)	Industrial connections (% change)	Commercial connections (% change)
Scenario 1	3.0	26,674	187,134	2.6	6.1
Scenario 2	1.9	25,714	167,112	-2.3	-0.1
Scenario 3	0.2	24,941	150,956	-14.5	-13.2

Source: CEPA analysis

Our forecasts show a wide range of potential outcomes for drivers of electricity demand during DPCR5, which highlights the great degree of uncertainty that has been brought about by the economic and financial developments of the past 18 months or so. Not surprisingly, the worsening of the macroeconomic environment is expected to have some negative impact on the drivers of electricity demand, and the worse the crisis is the greater the impact will be. For example, in scenario 1 the UK economy essentially returns to its pre-crisis position, meaning that electricity demand during DPCR5 would correspond to parameters observed during the boom years. In contrast, scenarios 2 and 3 show significantly different outcomes to the previous 10-15 years and highlight the fact that electricity demand during DPCR5 is likely to be strongly affected should the recession carry on beyond the current price control period.

We have supplemented the forecasts of the drivers of electricity demand with an indicative view of the potential level of electricity demand under each of the scenarios. We have not developed a full demand forecast, which would require detailed discussions with the DNOs to understand expected developments, such as major new connections or loads ceasing to take supply.

As with Workstream 1, at this stage we would propose that Ofgem considers each scenario on its own merits. However, we would assign the following probabilities to the three scenarios as follows:

- Scenario 1 - 50%. Scenario 1 fits most closely to the consensus view for the performance of the UK economy over the medium-term.
- Scenario 2 - 35%. Scenario 2 is seen as a real possibility by many economists. Despite RPI year on year growth recently falling to 0%, CPI currently remains more than 1% above the Bank of England's target. If this situation persists over a significant period of time the Bank will have to increase interest rates

potentially creating an outcome for the UK economy similar to the assumptions that guide Scenario 2.

- Scenario 3 - 15%. This scenario is seen as a possibility, but is less likely than either Scenarios 1 or 2. As stated above RPI has already fallen to 0%, and is expected to turn negative in the coming months. It is possible that this will lead to a prolonged period of deflation in the UK economy, though we would expect this to be a less likely outcome for the UK economy.

In this section we also looked at the historical relationships between the above factors and electricity demand. We noted a particularly strong correlation coefficient between GDP and both total electricity distributed and peak electricity demand. However, one should be careful about the implications of these observations for electricity demand during DPCR5 since the increased push towards energy efficiency means that historical relationships may no longer hold as closely as they have done in the past.

7. WORKSTREAM THREE - INCORPORATING INDEXATION OF REAL INPUT PRICES INTO ALLOWED REVENUE

7.1. Introduction

This Workstream is concerned with the key questions linked to the question of uncertainty about future input prices for DCPR5. Specifically, this Workstream considers:

- Whether a case for mitigation of uncertainty arises;
- If so, what the options for mitigation are;
- How a choice between those options would be made;
- What the design of a mitigation mechanism could look like, what parameters the detailed elements of the design require to be considered and what values they could take; and
- The impact of any such mechanism.

Each of these issues is considered in turn below.

7.2. The case for risk mitigation

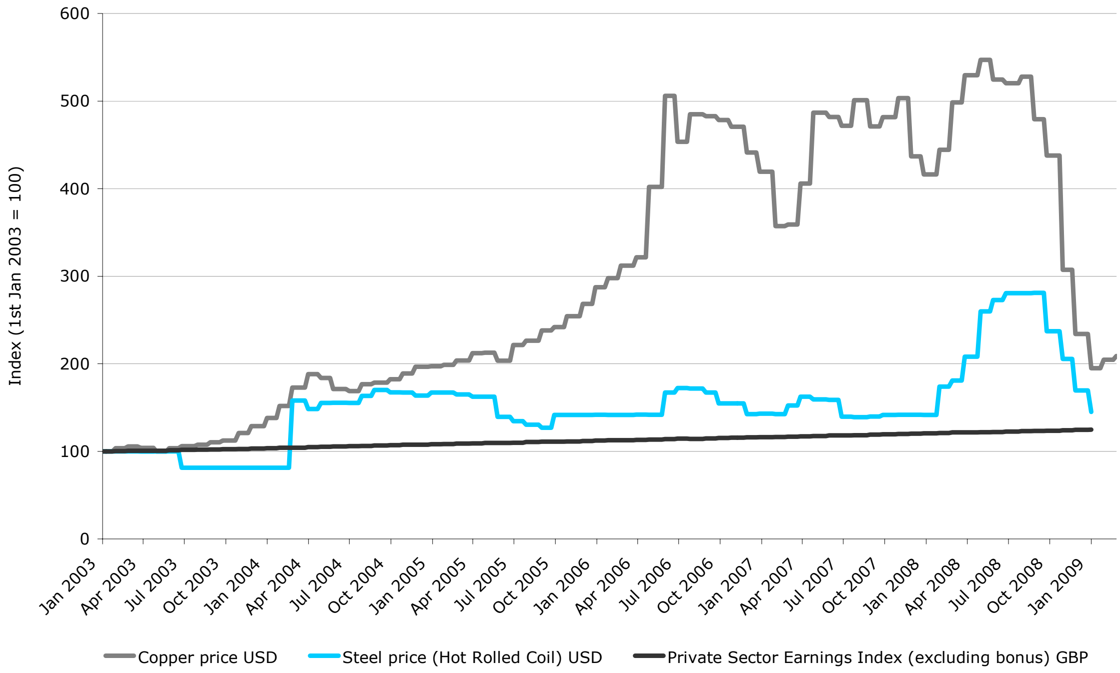
The case for risk mitigation has already been considered to some extent in Workstream 1. This evidence is summarised in the first sub-section and then considered relative to the key regulatory issue of controllability.

7.2.1. Volatility

It is clear that over the past five years there has been greater volatility in some of the key input price indices – especially commodity based ones like copper and steel. These are shown in Figure 7.1.[43]

[43] Comparisons with other more general indices are provided later in this section.

Figure 7.1: Index of copper and steel prices in USD



Sources: IMF, EconStats, Bank of England, ONS and CEPA analysis

The figure shows copper prices quintupled during the period before crashing back towards their 2004 value early in 2009. Steel prices have been less volatile but still have peaks where prices were nearly three times as high as their value at the beginning of the period.

Some of this volatility has arisen because of the pricing of these commodities in international markets is in US dollars rather than British pounds. Consequently, the exchange rate has an impact on the price and the significant moves in the USD/GBP exchange rate exacerbates some of the underlying volatility in the commodity price, although it reduced the overall impact in the fall in the commodity price in the last six months.

Other input indices have been much less volatile. For example, the private sector earnings index also shown in Figure 7.1 shows what appears to be a fairly predictable trend growth over this period. Of course, as Workstream 1 demonstrates, there are scenarios in which this predictable growth could be affected in the short-term but the likely impact is to mute the growth rate of wages, rather than to cause a reduction in earnings themselves in nominal wages. However, a small reduction in real wages could occur if inflation were to increase.

Overall, as discussed in Workstream 1, the uncertainty about the UK economy and the wider world economy over the coming years of the DCPR5 means that for some input indices there is significant uncertainty.

7.2.2. Controllability

Uncertainty by itself is not sufficient reason to introduce risk mitigation. A cost may be uncertain but if it is controllable then it is up to the management of the company to deal with the uncertainty. This leads to the key consideration of controllability. In a simple world costs could be characterised as controllable or uncontrollable and then those that are uncontrollable could be considered for risk mitigation. This is on the premise that management should only be rewarded/penalised for costs that are under its control. If a cost is uncontrollable, leaving the management with an incentive leads them to face possible windfall gains and losses.

In reality a simple characterisation of controllability is not possible. This is because:

- any cost can be broken down into a unit price and a volume and it is possible that the controllability of each is different; and
- many elements (unit price or volume) are "partly" controllable.

Consider Table 7.1. This provides a summary on our view about the underlying factors affecting the key cost items identified by Ofgem in the terms of reference for this work. From this it can be seen that there are quite a few drivers for unit prices and volumes for each of the categories and the table has limited itself to what we see as the most important drivers.

Table 7.1: Drivers for various cost items

Cost	Unit prices	Volume
Direct labour costs associated with electricity distribution	Base prices will be driven by national/ regional wage rates/cost of living Deviations around this could be driven by specific skill requirements, incentive/bonus payments etc	Size of company, volume of work (opex and capex) Incentive/bonus structures Use of overtime etc
Contracted labour costs associated with electricity distribution	Base prices will be driven by national/regional wage rates/cost of living Incentive structures within contracts Demand for the skill sets in international/ national/regional/local markets	Size of company, volume of work (both opex and capex)
Cables and overhead conductors	Input prices (steel and copper) Exchange rates	Replacement capex Expansion capex
Transformers and switchgears	Producer price inflation International demand and supply Input prices	Replacement capex Expansion capex
Civils including access routes, site preparation, operational building	Wage aspects will be driven by same forces as contracted labour	Scale of capex projects
Other input costs including rent, insurance, transport and IT	National and international markets Location of company	Size and geographic dispersion of company Technology Legal requirements for insurance etc

From this information it is then possible to consider whether these drivers are controllable. Table 7.2 considers the controllability of the unit price drivers and Table 7.3 the volume drivers.

Table 7.2: Controllability of unit price drivers

Driver	Controllability	Rationale
Direct labour costs associated with electricity distribution		
Base prices will be driven by national/regional wage rates/cost of living	Not controllable	Determined by national and international forces
Deviations around this could be driven by specific skill requirements, incentive/ bonus payments etc	Controllable to a fair degree	Company has control over the design of bonus structures, whether skills are kept in-house etc.
Contracted labour costs associated with electricity distribution		
Base prices will be driven by national/regional wage rates/cost of living	Not controllable	Determined by national and international forces
Incentive structures within contracts	Controllable to a fair degree	Company has control over the design of bonus structures
Demand for the skill sets in the international/national/ regional/local markets	Not controllable	Demand for contract services likely to be driven by external factors – for example an Olympics impact in the South East is possible, as well as a Terminal 6 impact etc.
Cables and overhead conductors		
Input prices (steel and copper)	Not controllable	Set by international demand and supply of the commodities and production
Exchange rates	Not controllable	Set by financial markets
Transformers and switchgears		
Producer price inflation	Not controllable	Set by national and international forces
International demand and supply	Not controllable	Set by investment requirements in other countries and production facilities
Input prices	Not controllable	Set by national and international demand and supply
Civils including access routes, site preparation, operational building		
Wage aspects will be driven by same forces as contracted labour	See above	
Other input costs including rent, insurance, transport and IT		
National and international markets	Not controllable	Clearly outside the control of the company in the short-term.
Location of company	Not controllable	Outside the control of the company although some choice within a region may exist (but not a short-term option).

Table 7.3: Controllability of volume drivers

Driver	Controllability	Rationale
Direct labour costs associated with electricity distribution		
Size of company, volume of work (both opex and capex)	Very limited controllability	Mostly determined by forces outside the company's control, but there is some ability to cut back or change the sequence on certain types of expenditure
Incentive/bonus structures	Controllable	Management decision – some external pressure from the approach adopted by other companies may exist
Use of overtime etc	Partly controllable	Decisions about to hire additional staff, use contract staff etc are within the control of management – but there may be very short-term constraints on the ability to use some options
Contracted labour costs associated with electricity distribution		
Size of company, volume of work (both opex and capex)	Very limited controllability	Mostly determined by forces outside the company's control, but there is some ability to cut back or change the sequence on certain types of expenditure
Cables and overhead conductors		
Replacement capex	Partly controllable	Some discretion over timing of some replacement capex
Expansion capex	Not controllable	Driven by external factors
Transformers and switchgears		
Replacement capex	Partly controllable	Some discretion over timing of some replacement capex
Expansion capex	Not controllable	Driven by external factors
Civils including access routes, site preparation, operational building		
Scale of capex projects	Very limited controllability	In principle the company may be able to re-sequence projects and find ways of increasing scale etc
Other input costs including rent, insurance, transport and IT		
Size and geographic dispersion of company	Not controllable	Clearly outside the control of the company
Technology	Not controllable	Innovation possible over the long-term?
Legal requirements for insurance etc	Not controllable	Driven by national policy/legal decisions

When considering controllability it is important to be clear as to what is under consideration. In table 7.2 the focus is on the short- to medium-term covered by the life of the price control period. Clearly in the longer-term there may be a greater degree of flexibility inasmuch as significant changes can be made, but these are ignored since the concern is about DCPR5. There may also be actions that a company could take to mitigate some of the uncontrollable nature of a cost. These are not considered in this analysis but will be returned to in the following section if regulatory involvement in the risk mitigation is worth considering.

7.2.3. Implications

What are the implications of the analysis summarised in Tables 7.2 and 7.3? For those elements that are not controllable (either fully or mostly) there is then a question as to whether sufficient volatility/uncertainty about the future costs exists for risk mitigation to be a serious consideration. Table 7.4 considers the main cost elements and their controllability and predictability (this is partly based on the correlation with general inflation as well as a view about the future).

Table 7.4: Decisions about the need for risk mitigation

Cost	Unit prices	Volume
Direct labour costs associated with electricity distribution	Not controllable but predictable and so does not require risk mitigation	Partly controllable but also mostly predictable and so does not require risk mitigation
Contracted labour costs associated with electricity distribution	Not controllable but relatively predictable and so does not require risk mitigation	Partly controllable but also mostly predictable and so does not require risk mitigation
Cables and overhead conductors	Not controllable and not predictable and so some form of risk mitigation may be appropriate. Not clear if both input price and exchange rate risk should be mitigated	Partly controllable but also mostly predictable and so does not require risk mitigation
Transformers and switchgears	Not controllable and not fully predictable and so some form of risk mitigation may be appropriate. Input prices may suffer from the mix of raw price and exchange rate risk noted for cables and overhead conductors.	Partly controllable but also mostly predictable and so does not require risk mitigation
Civils including access routes, site preparation, operational building	Not controllable but relatively predictable and so does not require risk mitigation	Partly controllable but also mostly predictable and so does not require risk mitigation
Other input costs including rent, insurance, transport and IT	Not controllable but predictable and so does not require risk mitigation. Possible that some elements, like insurance, may need risk mitigation but not clear	Mostly fixed and so predictable.

From this table it can be seen that although many of the unit price and volume elements are outside the control of the company they are predictable and consequently it should be possible to form good estimates of the likely cost for the price control period. As such, it would seem that additional risk mitigation for these elements is not appropriate. There are, however, a small number of elements – all unit price related – that do deserve further analysis and possible additional risk mitigation incorporated into the regulatory regime.

7.3. Approaches to risk mitigation

This section considers the various approaches to risk mitigation that exist and then assesses which one, or mixture, should be used for the small set of uncontrollable and unpredictable unit costs identified in Section 7.2.

7.3.1. Alternative approaches

What approaches to risk mitigation exist? Essentially there are three broad approaches, with sub-options within some of them. These three approaches are:

- to acknowledge that uncertainty exists but do nothing, explicitly leaving the problem with the company;
- to provide some form of fixed *ex ante* insurance, this could take the form of:
  - headroom built into the estimate of the unit price used for forecasting the future costs, which captures the uncertainty about the future price; or
  - using financial markets to provide the protection through hedging the future costs (or associated costs if no direct hedge is available) – with the costs of the optimal degree of hedging being passed on as a fixed/ predictable cost to customers; and
- to shift the risk of the uncertainty away from the company and to customers, leaving them subject to uncertainty about what cost they will actually pay, this could be done through either:
  - a trigger/indexation based system that passes on "significant" changes to customers but does not pass on "noise"; or
  - 100% pass-through of the uncertain costs.

7.3.2. Choosing an option

Which of the options for risk mitigation ought to be used in which situation? Factors that could influence a decision include:

- the materiality of the uncertain cost item – less material costs might either be left with the company or dealt with through simple fixed insurance;
- the cost of the risk mitigation relative to the cost of the uncertainty – if formal risk mitigation is used, what is the cost of that mitigation? For example, hedging involves transaction fees which may be significant and consequently the removal of the uncertainty needs to be valued highly by customers as the transaction cost is incurred whether the cost proves uncertain or not;[44] and

[44] For example, hedging copper prices through use of the London Metals Exchange involves a deposit of USD550 per tonne – about 14% of the average price of copper during 2008. It is also possible that longer dated hedges may be less liquid – the exchange offers hedges up to 63 months out but we have not been able to ascertain the liquidity of longer-dated hedges.

- the broader implication for customers with respect to: (i) aspects that they value highly such as stable and predictable prices; and (ii) incentives on the companies to be cost-efficient.

It may be possible to mitigate some of these aspects through the design of the actual mechanism. For example, logging-up can remove price volatility at least within the price control period.

7.3.3. Way forward

If the three factors that are set out above are considered for the key uncertain cost elements it is clear that:

- doing nothing is not tenable as the costs are material;
- some form of insurance may be appropriate for some costs but only if the price of hedging is sufficiently low and the markets are sufficiently liquid and long-dated to handle the sector's requirements. Headroom is inappropriate owing to the degree of uncertainty associated with the cost items; and
- passing the risk on to consumers is workable but some form of incentive should be retained and so 100% pass-through is not appropriate. There will be costs associated with the implementation of this risk mitigation in terms of regulatory reporting and monitoring.

So, overall it would appear that either some form of indexation should be adopted or hedging considered. Since the information on the cost and liquidity of hedging of commodity prices is uncertain we will focus on the trigger/ indexation approach although further consideration should be given to hedging (especially if commodity prices are indexed in dollars with the exchange rate risk hedged).

7.4. Developing a trigger based system

This section addresses the key design issues involved in establishing a trigger based system. Then some possible mixtures of the key parameters are considered with the two key input price indices for copper, steel and a composite index – the choice of the most appropriate index is addressed at the end of this section. The revenue implications of any mechanism are dealt with in the following section. Lastly, we provide an explanation of the process by which a trigger mechanism is converted into a revenue implication.

7.4.1. Design issues

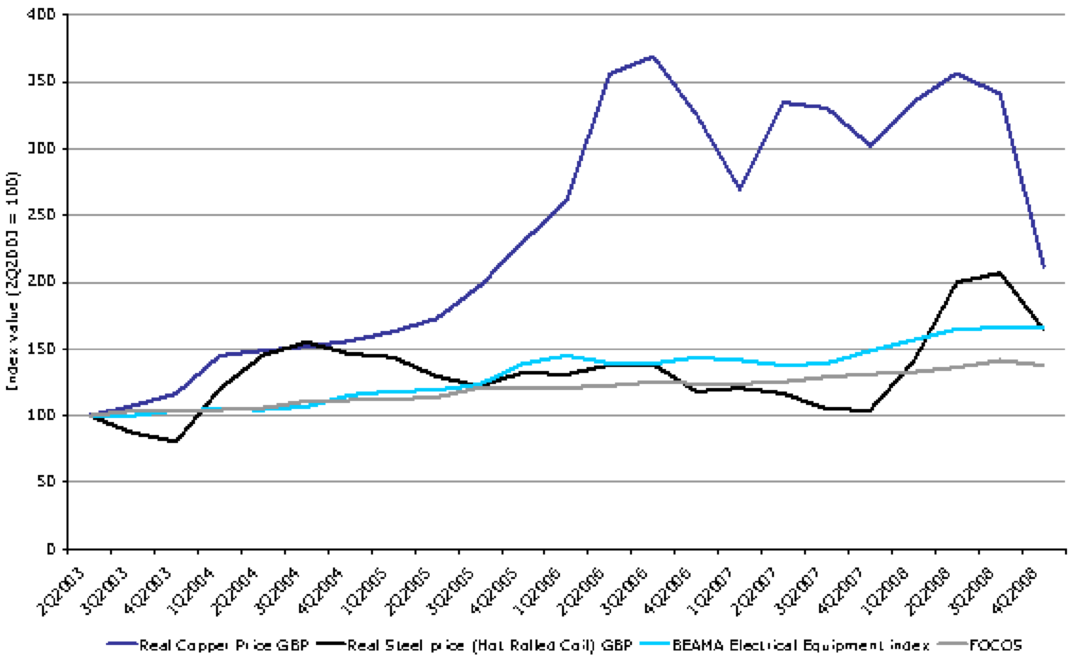
Choice of index

The first major design issue is linked to which index/ indices should be used for the mechanism. There is a basic decision between choosing a general index which could be applied to a whole category of costs or choosing one or more specific indices which reflect more closely specific cost elements.

From Workstream 1 it is clear that the two indices that capture the category of costs that we believe could be subject to indexation are the BEAMA Basic Materials Electrical Index and the BERR FOCOS Resource Cost Index of Infrastructure: Labour and Plant. However, the real underlying uncertainty would seem to arise from the copper and steel prices.

Consider Figure 7.2 below.

Figure 7.2: Comparison of general and specific indices at a quarterly frequency



Sources: IMF, EconStats, Bank of England, BEAMA, BERR and CEPA analysis

What is clear from the figure is that all four indices move in similar ways but that the level of impact is quite different. This reflects the fact that the specific indices only apply to a subset of the costs and so the averaging impact of the general indices leads to lower volatility as the other costs have been less volatile. To characterise the relationship further consider the correlation coefficients shown in Table 7.5.

From this it is clear that there is a high degree of correlation – both between the general indices and between the general and specific indices. As such there are a couple of simple choices:

- the use of specific price indices applied to a proportion of the relevant cost items or general indices applied to the whole cost item; and
- the use of two general indices or one.

While in principle it would be more precise to use specific indices applied to a proportion of costs this increases complexity and monitoring issues. If the aim is to produce something simple and focused then use of a single general index might seem most appropriate. However, the benefit of being focused on purely uncontrollable items implied through the use of specific indices would seem to outweigh the costs associated with the complexity.

Table 7.5: Correlation coefficient between the general and specific indices

	Quarterly correlation coefficient with BEAMA	Annual correlation coefficient with BEAMA	Quarterly correlation coefficient with FOCOS	Annual correlation coefficient with FOCOS
Copper price USD	0.82	0.83	0.84	0.85
Real Copper Price USD	0.79	0.80	0.81	0.81
Copper price GBP	0.86	0.88	0.87	0.89
Real Copper Price GBP	0.83	0.85	0.84	0.85
Steel price (Hot Rolled Coil) USD	0.70	0.81	0.72	0.83
Real Steel price (Hot Rolled Coil) USD	0.59	0.70	0.61	0.72
Steel price (Hot Rolled Coil) GBP	0.68	0.77	0.69	0.77
Real Steel price (Hot Rolled Coil) GBP	0.55	0.64	0.56	0.64
Private Sector Earnings Index (excl bonus) GBP	0.97	0.99	0.99	1.00
USD/GBP	0.43	0.22	0.40	0.28
RPI	0.95	0.97	0.98	0.99
BEAMA Electrical Equipment Index	-	-	0.97	1.00
FOCOS	0.97	1.00	1.00	-

Sources: IMF, EconStats, Bank of England, ONS, BEAMA, BERR and CEPA analysis

For the remainder of this section we will consider copper, steel and BEAMA indices in the mechanisms.

Index all movements or use tolerance bands?

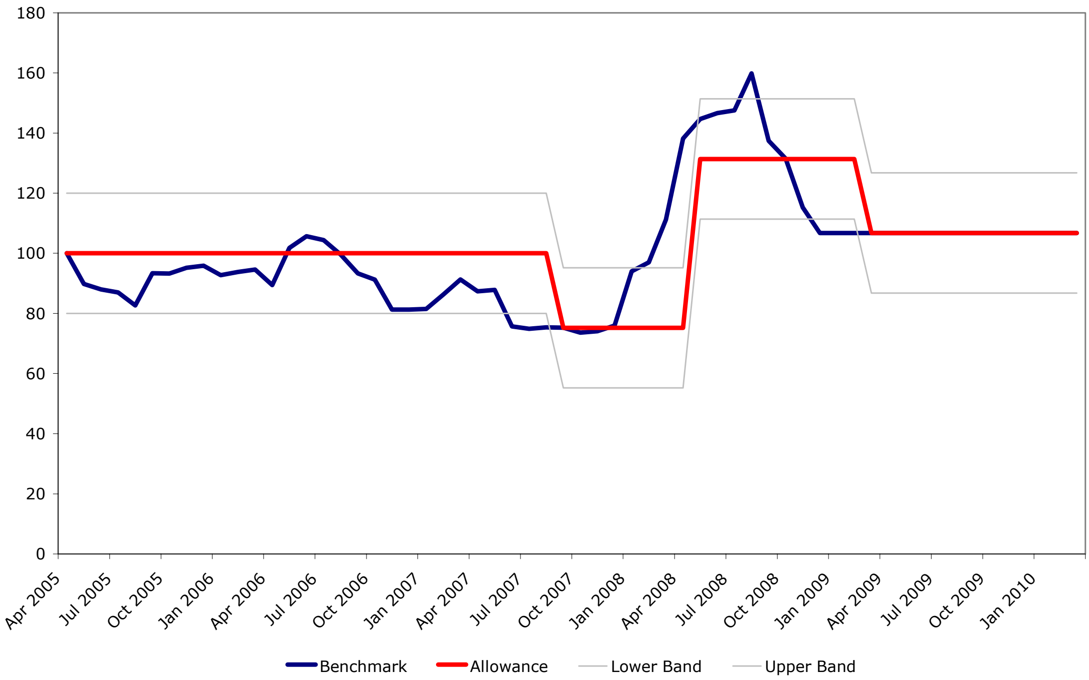
Since there is a desire to retain some incentives on companies to exploit whatever controllability exists it would seem to be appropriate to set risk-mitigating mechanism such that small changes in the unit price are not passed on to customers but significant changes are captured.

Therefore, we suggest that the indexation mechanism should have a 'tolerance band' and that if changes in the actual cost benchmark from the base year value do not exceed the 'width' of the tolerance band then there would be no adjustment to the allowed unit price.

The width of the tolerance band would need to be decided as part of the overall design of the mechanism. In principle, the closer the *ex ante* allowed unit price to the spot rate (and therefore the smaller the 'insurance premium' against fluctuations in the unit price), the narrower the tolerance band should be. Therefore the width of the tolerance band should be decided at the same time as the *ex ante* allowed unit price is decided.

The difference between continuous indexation and a mechanism based on triggers and tolerance bands is illustrated in the following example of a steel price based mechanism.[45] Full indexation would result in part of expenditure allowances exactly following movements in the spot price of steel, as shown by the blue benchmark line in Figure 7.6 The movement of allowances under a sample mechanism with tolerance bands is illustrated by the red allowance line, here tolerance bands have been set at 20 percentage points. Table 7.6 summarises a selection of outputs from the mechanism. This shows that over the stylised control period investigated, the mechanism would result in allowances being reset only three times, providing much greater certainty than under direct indexation, but accommodating significant shifts in the input price.

Figure 7.6: Configuration for indexing the steel price in real GBP terms over DPCR4 with 20% tolerance bands



[45] This example is investigated in greater detail in section 0 as 'steel configuration 1'

Table 7.6: Model settings and outputs - 20% tolerance bands for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*3*
Tolerance:	*20ppts*	Upward adjustments:	*1*
Periodicity:	*3 months*	Downward adjustments:	*2*
Reset value:	*Breach period average*	Average upward adjustment:	*56.2ppts*
		Average downward adjustment:	*-24.7ppts*
		Average allowance:	*103.38*

The second example below shows the impact of narrowing the tolerance bands to only 10 percentage points.[46] This brings the mechanism closer to the underlying benchmark index but resets much more frequently; a total of 9 times in the following illustration.

Figure 7.7: Configuration for indexing the steel price in real GBP terms over DPCR4 with 10% tolerance bands

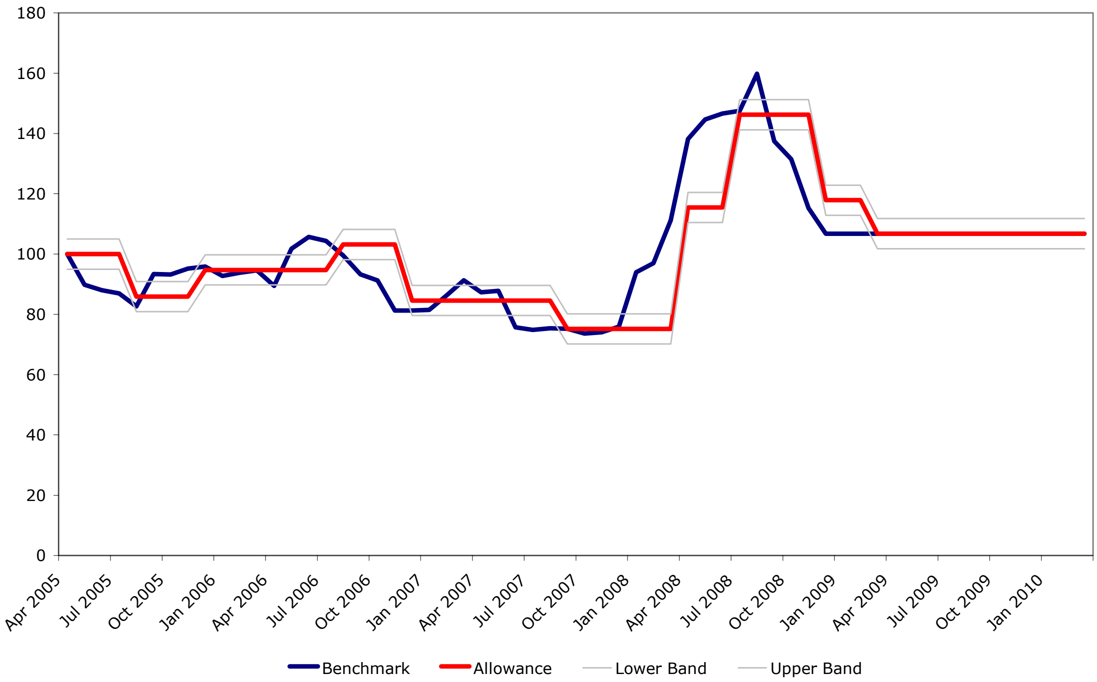


Table 7.8: Model settings and outputs - 20% tolerance bands for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*9*
Tolerance:	*5ppts*	Upward adjustments:	*4*
Periodicity:	*3 months*	Downward adjustments:	*5*
Reset value:	*Breach period average*	Average upward adjustment:	*22.1ppts*
		Average downward adjustment:	*-16.3ppts*
		Average allowance:	*100.35*

[46] This example is investigated in greater detail in section 7.5.1 as 'steel configuration 5'

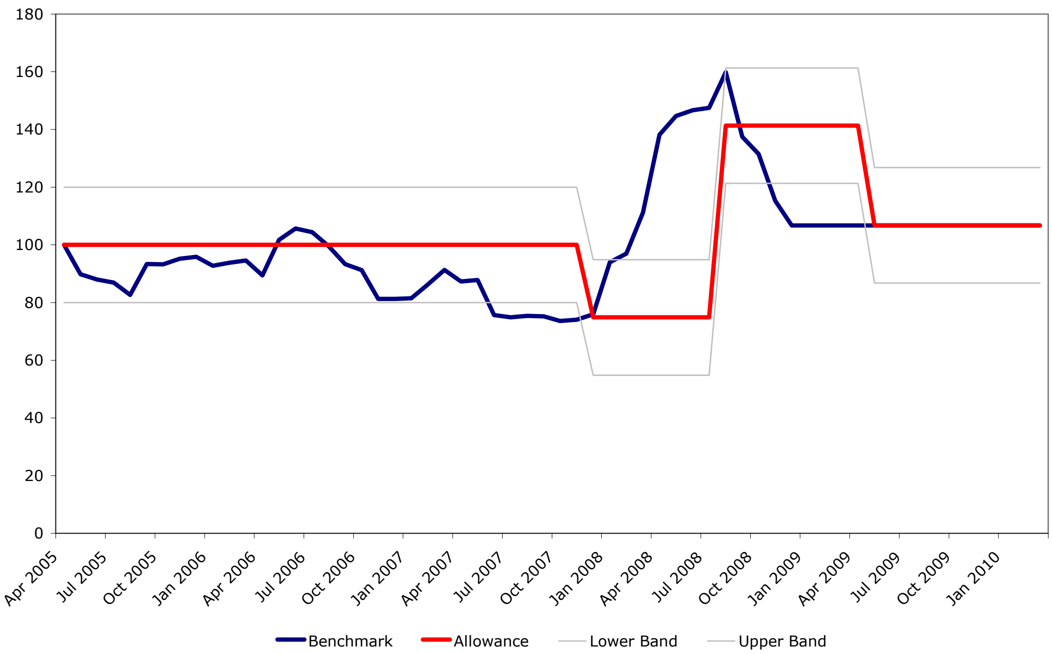
The choice of an appropriate tolerance band width is explored in greater detail in Section 7.5.

Periodicity/ amount of adjustment

Rules would be required defining triggers for when an adjustment to the allowed unit price would accrue. Would an adjustment accrue as soon as the benchmark value fell outside the tolerance band or would it have to remain outside for a sustained period? Rules might specify, for example, that the benchmark value would have to fall outside the tolerance band for *n* consecutive periods (weeks/months/quarters) to trigger the adjustment mechanism. The decision about the value of *n* would be made at the same time the width of the tolerance band was set. The broader the tolerance bands, the smaller the value of *n* that should be chosen.

Figures 7.6 and 7.7 are based on the trigger requirement of three months outside the tolerance bands. Increasing this duration reduces the sensitivity of the model to temporary changes, but can result in unresponsiveness to sharp, sudden movements. The following example is a permutation of the first example above, where six month periodicity is applied.[47] The result of changing this single parameter is actually no change in the number of adjustments. However the lags in adjustment are so large that the sharp increase and decrease in 2008 would be largely missed, with an upward response only just as the value was decreasing – this is also an impact of the choice of tolerance band.

Figure 7.8: Configuration for indexing the real steel price in GBP terms over DPCR4 with 6 month periodicity



[47] This example is investigated in greater detail in section 7.5.1 as 'steel configuration 4'

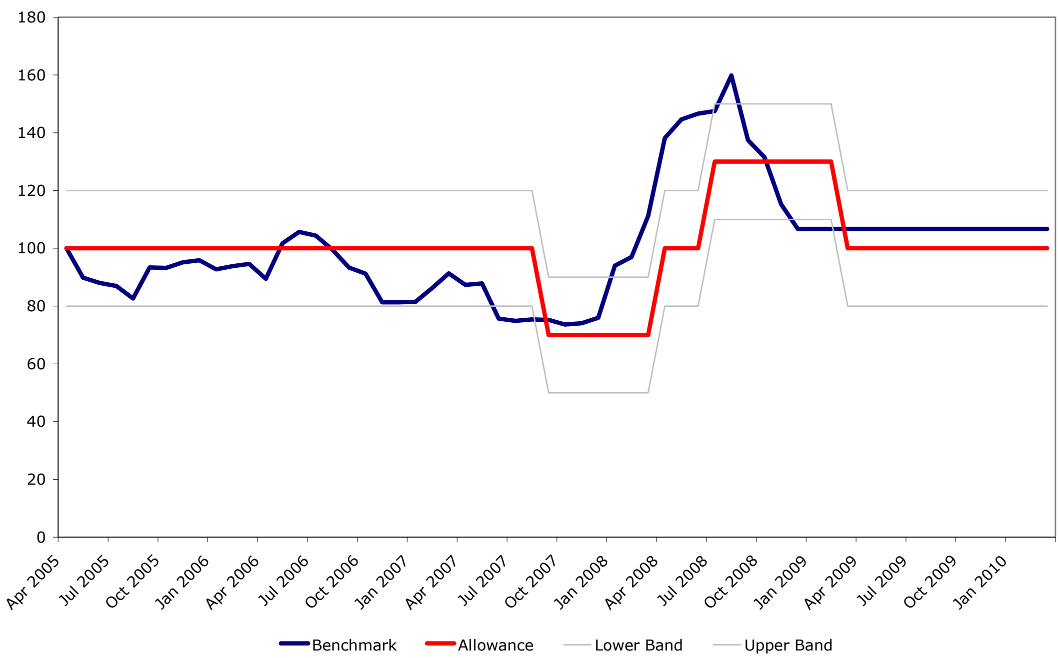
Table 7.9: Model settings and outputs – 6 month periodicity for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*3*
Tolerance:	*20ppts*	Upward adjustments:	*1*
Periodicity:	*6 months*	Downward adjustments:	*2*
Reset value:	*Breach period average*	Average upward adjustment:	*66.5ppts*
		Average downward adjustment:	*-29.9ppts*
		Average allowance:	*104.09*

Rules would also be needed setting out the amount of the adjustment to the allowed unit price if the mechanism was triggered. For example, the adjustment might be the full amount by which the benchmark exceeded the base year value or the amount it exceeded the tolerance band or some other amount pre-specified in the indexation arrangements. Decisions about the amount of the adjustment should be taken at the same time as decisions about the other elements of the indexation mechanism.

Figures 7.6 and 7.7 are based on resetting the allowance at an average of the values that breached the tolerance bands and triggered the reset. This is just one example of how it could be reset. This allows a certain degree of flexibility. However, certainty could be increased by setting the percentage increments of any adjustment at a particular value. This could be specified either as a multiple of the tolerance band width or another fixed value. The following example illustrates fixing readjustments at 1.5 times the tolerance band width (30 percentage points).[48]

Figure 7.9: Configuration for indexing the real steel price in GBP terms over DPCR4 with restricted index adjustments



[48] This example is investigated in greater detail in section 7.5.1 as 'steel configuration 2'

Table 7.10: Model settings and outputs – restricted index adjustments for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*4*
Tolerance:	*20ppts*	Upward adjustments:	*2*
Periodicity:	*3 months*	Downward adjustments:	*2*
Reset value:	*One-and-a-half times tolerance*	Average upward adjustment:	*30ppts*
		Average downward adjustment:	*-30ppts*
		Average allowance:	*100.5*

This example shows how a set allowance value can lead to both over- and under-shooting of the underlying benchmark index. The allowance partly overshoots in response to small breaches of the tolerance bands, but reacts slowly to the later rapid increase. Therefore, although there are some merits to setting fixed adjustments, choosing the appropriate size must be done with care.

Method for adjusting allowed revenues

There are various options for adjusting allowed revenue to fund the adjustment if it accrues.

- ***Option 1: Logging up/down.*** If an allowed revenue adjustment is used then one option is for the accrued revenue to be 'logged-up/down' and funded at the next price control review. The deferral in receipt of the extra revenue could be acknowledged by allowing interest from the time the additional revenue accrued until it was funded in the subsequent price control review. The merit of this approach is three-fold. First, there is no increase in price uncertainty over the five year period to which indexation applies. Second, logging up/down is a recognised mechanism for dealing with unplanned intra-period change and therefore minimises the amount of regulatory change. Third, if it is believed that some degree of mean reversion exists in the unit price then netting out of cost increases and decreases during the price control period can be undertaken without creating price volatility since the net position would be passed-on to customers at the next price determination.
- ***Option 2: Interim determination.*** If additional allowed revenue is logged up/down and paid in the next price control period it is possible that the regulated company could find that cash flow was squeezed in the current period to the extent that its rating came under threat because cash flow cover was reduced (assuming that the cost item is sufficiently material). This is not very likely but should the situation arise it may be appropriate to allow a company the right to seek an interim determination. This would reduce market concerns about the

introduction of an indexation mechanism and is consistent with established regulatory practice.[49]

- ***Option 3: Automatic adjustment mechanism.*** This approach involves setting an automatic mechanism to adjust the allowed revenues intra-period once adjustment had accrued. Unlike logging-up/down or the interim review, this approach allows the regulated company to adjust its maximum charges to recover the additional allowed revenue within the five year period. This approach raises greater issues than the other mechanisms about uncertainty for customers/users about prices over the five year period.

We recommend that funding of accrued adjustments arising from the indexation mechanism should normally be by way of logging-up/down for inclusion in maximum prices for the subsequent price control period. However, provision should be retained for a company to seek an interim review in exceptional circumstances where it can show evidence that it would face significant financeability or creditworthiness issues during the period as a result of delay in funding of the accrued adjustment. This could be achieved through a clearer definition of the shipwreck clause.

Trade-offs

Overall, there are clearly some trade-offs to consider when choosing parameters for the design of a mechanism. They are:

- the link between the tolerance bandwidth and periodicity required for an event to be triggered; and
- the form of reset and the method for adjusting revenues.

With the former it is clear that tighter tolerance bands ought to be linked to longer periods of breaching the band before a trigger event occurs, while with the latter resets that lead to over- or under-shooting are less of a problem when linked to logging-up.

7.4.2. Parameter choices in benchmarking methodology over DPCR4

Using historical data, we can illustrate the impact of a number of different benchmarking mechanism design choices for steel prices, copper prices and BEAMA Electrical Equipment Index values. The recent path of each benchmark series provides some insight into the type and magnitude of price movements that indexation could have to deal with in the future, and highlights important issues for design. It should be noted that this section is intended as an exploration of potential trigger mechanisms and does not aim to predict how much a DNO might expect to gain or lose under such a regime.

[49] Of course, if a general shipwreck type clause exists for re-opening a price review then this may offer sufficient protection.

7.4.3. Model mechanics

We have developed and provided to Ofgem along with this report a model that draws on observable input price indices, and initial DNO opex and capex allowances for DPCR4.[50] These data series are collected in the 'Data' and 'DNO' sheets of the model. The 'Data' sheet draws in the following five series starting in April 2005 (the start of DPCR4) and ending at the latest records available in March 2009:

- **Steel prices** – end of month price per tonne of hot rolled steel in USD, sourced from EconStats.
- **Copper prices** – London Metals Exchange spot price, USD per tonne, sourced from the IMF Primary Commodity Prices database.
- **BEAMA Electrical Equipment index** – a composite price index of materials used in basic electrical equipment industries, including steel, copper and plastics; purchased from the British Electrotechnical & Allied Manufacturers' Association.
- **USD/GBP daily spot exchange rates** – sourced from the Bank of England.
- **Monthly RPI index values** – sourced from the UK Office for National Statistics (ONS).

The first three of these series were transformed into indices (found in the 'Indices' sheet), which are based at 100 on 30 April 2005, the end of the first month of DPCR4. The final two series were used to convert each index into GBP terms and to adjust for inflation. As each data series does not reach to the end of DPCR4, the model provides the option to generate simple scenarios for their future path within the model. This aims to be illustrative, rather than providing a forecast of future values. Each scenario can be selected in the 'Control' sheet, is generated in the 'Index scenarios' sheet and illustrated in the 'Index scenario chart'. The resulting series can be used as benchmark indices under the trigger mechanism.

The trigger mechanism developed in the model generates hypothetical new opex and capex allowances that are reset under clearly defined circumstances in the following manner. A benchmark index series (chosen in the 'Control' sheet) is monitored at a monthly frequency. It cannot trigger any change in the allowance if its value remains within symmetric tolerance bands either side of the current allowance value (initially set at 100). However, if the index breaks either of these bands for a set number of consecutive months, the allowance value is reset to a pre-defined level.

This mechanism is therefore based on three core parameters (discussed in Section 7.4.1) that determine its character:

- the width of the tolerance bands, (the percentage point change of the benchmark index that could lead to resetting of the allowance);

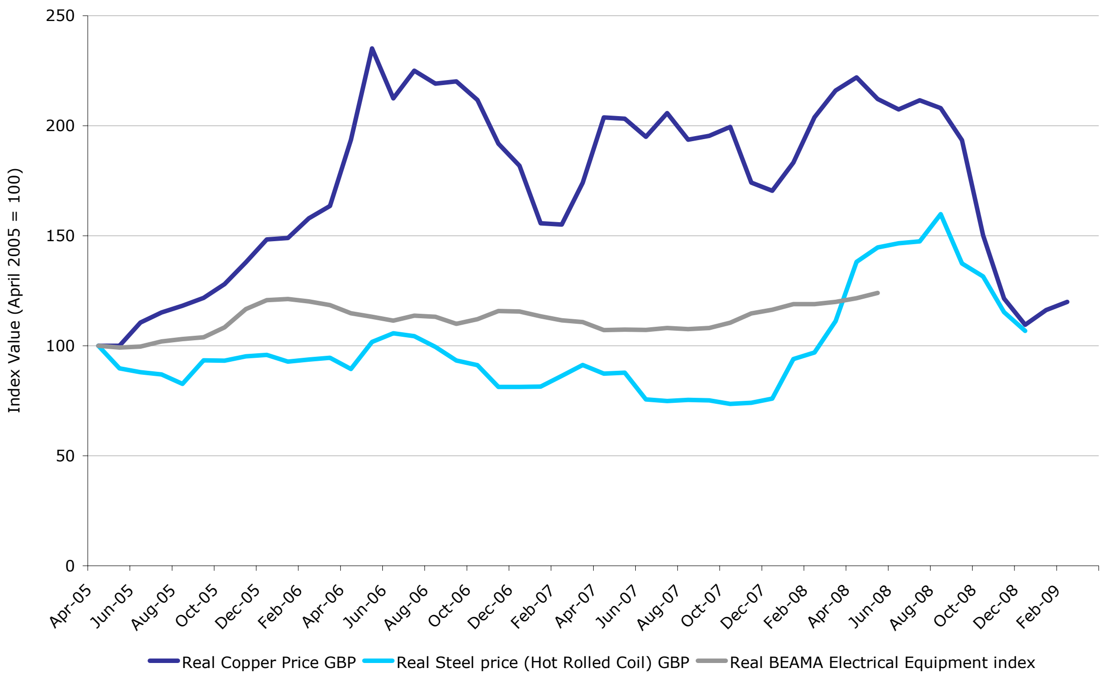
[50] Ofgem (2004) 'Electricity Distribution Price Control Review – Final Proposals'.

- the number of months that the tolerance bands would have to be exceeded in order to reset to a new allowance; and
- the value that the allowance shifts to once a change is triggered (this could be an average of the tolerance breaching values or a multiple of the tolerance band width).

Once the trigger mechanism has been constructed, hypothetical revenue impacts can be investigated through applying the prescribed adjustments to portions of opex and capex allowances of a representative DNO.[51]

The effectiveness of any particular trigger configuration is dependent on the nature of the benchmark index it is used to monitor. Tracking each of the series in the current model (see Figure 7.10) has its own difficulties. Their paths to date do not necessarily signal their future, but highlights potential challenges. So far over DPCR4, real steel prices have stayed relatively close to their original level, but experienced a sharp rise and fall through 2008. Real copper prices have been much more volatile, doubling within the first year, fluctuating widely and then returning to their original level. Real BEAMA fluctuations have been much more moderate, following a gradual but lumpy rise.

Figure 7.10: Real copper, steel and BEAMA electrical equipment indices 2005-2009



Sources: IMF, EconStats, Bank of England, ONS, BEAMA and CEPA analysis

The overall impact of the mechanism on DNOs ultimately depends on the size of the portion of opex and capex allowances it is applied to. This model assumes that the portion of allowances exposed to the mechanism should be set to be representative of the input prices it is designed to follow. For example, if aluminium was typically 10% of capex, a benchmarking mechanism following aluminium prices would be applied to 10%

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[51] Constructed as an average of the initial opex and capex allowances set at the start of DPCR4

of the capex allowance. The strong, but matching, assumption is taken in the model that costs directly follow the benchmark index, but the allowance they receive follows a path set by the trigger mechanism. It is assumed that costs exactly equal the allowance for the unindexed portion of expenditure. This allows calculation of an 'impact' figure as the difference between the index allowance and the benchmark index, expressed in £m (2002/3 prices).

The current model uses the following figures in Table 7.11 as the portions of opex and capex in the model exposed to the benchmarking mechanism.

Table 7.11: Indicative percentages of opex and capex allowances indexed in benchmarking model

	% opex indexed	**% capex indexed**
Copper	0.0	3.7
Steel	0.0	4.5
BEAMA Electrical Equipment Index	0.0	17.5

Further investigation would result in more accurate weightings for each index. In particular, there may be scope for indices to influence a portion of opex allowances, something that the model has been developed to accommodate. The BEAMA Electrical Equipment Index covers a wide range of inputs and as such represents a larger portion of capex than either copper or steel; two components of its weighted basket of inputs.

Once the percentages of opex and capex to be indexed are set, outcomes under the current regime can be compared to those with an element of indexation. As suggested above, there are numerous ways in which the trigger mechanism could be configured. A small number of these are explored in Section 7.5.

7.5. Parameter experimentation

This section provides a number of worked examples of indexation specifications in order to illustrate the effects of different parameter settings in the model. Each configuration aims to illustrate an important design issue but does not attempt to identify an ideal set of parameter settings.

7.5.1. Steel indexation

This subsection covers five index configurations based on real GBP steel prices. The steel price series currently used in the model is only available up until December 2008. Therefore, a simple scenario of constant real prices was selected to represent this series for the remaining periods of DPCR4. Please note that this is an illustration rather than a forecast.

The first configuration in this section sets tolerance bands of 20% either side of the current allowance that trigger a reset to the breaching average following three consecutive months outside the bands. Figure 7.11 illustrates the trigger mechanism and Table 7.11 summarises outputs from the model.

This model calibration results in three allowance resets over the price control period. The allowance shifts up to accommodate the rapid price rise in early 2008, but also allows consumers to benefit when prices later fall. The fact that steel is only a small portion of the overall allowances means that the overall benefit to the representative DNO of moving to an indexation mechanism would be £0.76m (in 2002/3 prices) or 0.15% increase in their total price control period capex allowance.

Figure 7.11: Configuration 1 for indexing the steel price in real GBP terms over DPCR4

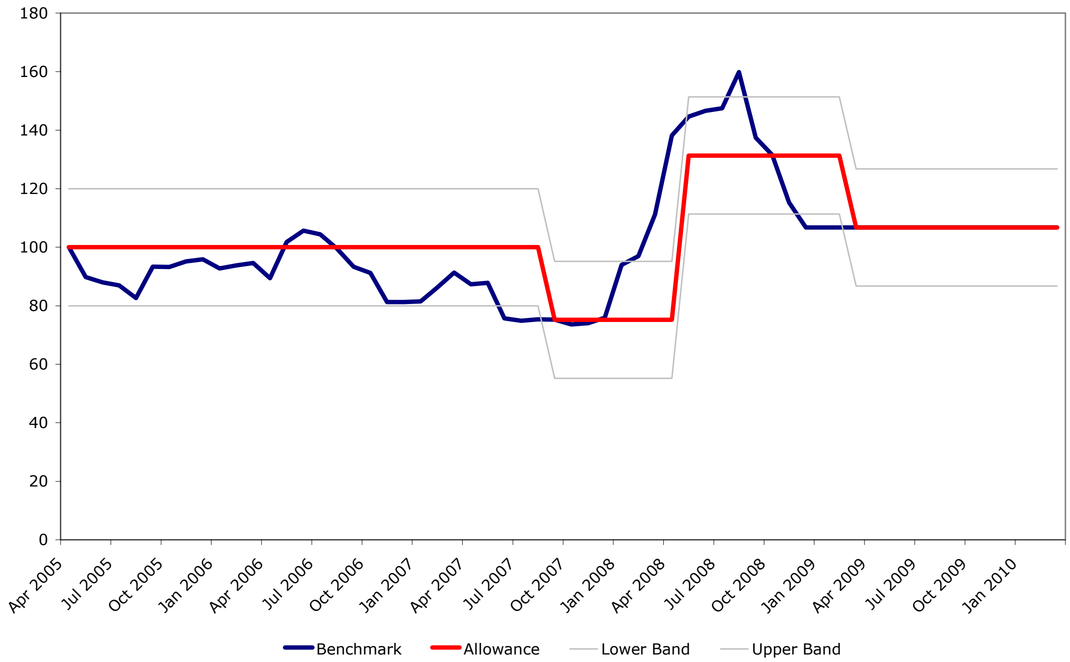

Table 7.11: Model settings and outputs for configuration 1 for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*3*
Tolerance:	*20ppts*	Upward adjustments:	*1*
Periodicity:	*3 months*	Downward adjustments:	*2*
Reset value:	*Breach period average*	Average upward adjustment:	*56.2ppts*
		Average downward adjustment:	*-24.7ppts*
		Average allowance:	*103.38*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.00%	0.00%	0.00
2006/7	0.00%	0.00%	0.00%	0.00
2007/8	0.00%	-0.65%	-0.40%	-0.65
2008/9	0.00%	1.11%	0.68%	1.10
2009/10	0.00%	0.30%	0.19%	0.30
Total	*0.00%*	*0.15%*	*0.09%*	***0.76***

Steel configuration 2 illustrates a slight modification of scenario 1. The incremental resetting value is set as a multiple of 1.5 times the tolerance margin, rather than as an average of the tolerance breaching values. All other parameter values remain unchanged.

Figure 7.12: Configuration 2 for indexing the real steel price in GBP terms over DPCR4

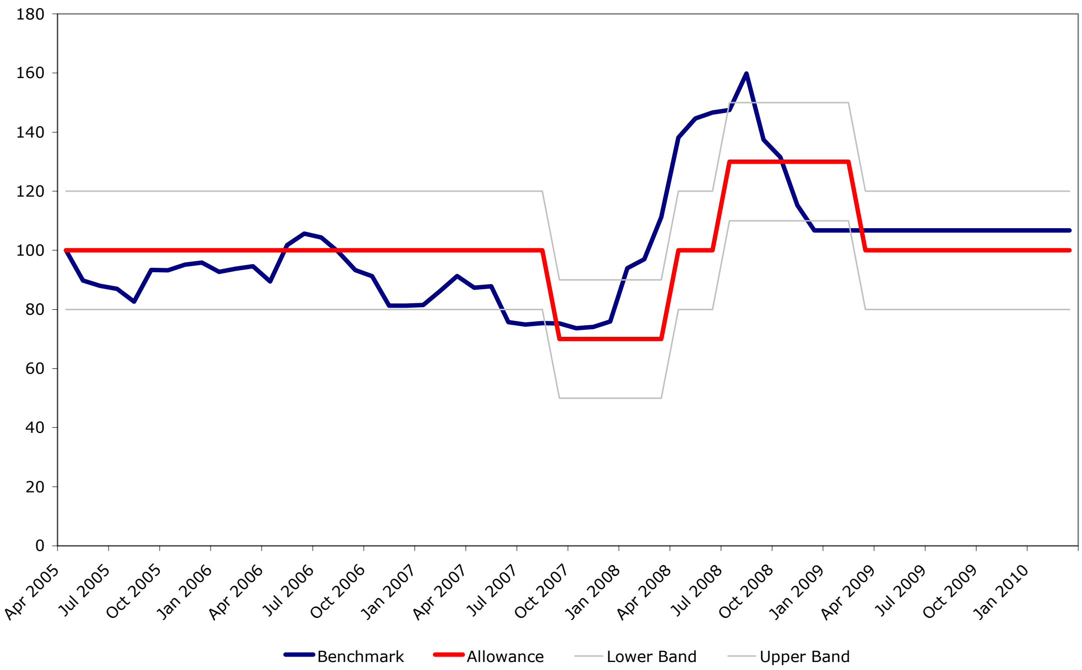

Table 7.12: Model settings and outputs for configuration 2 for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*4*
Tolerance:	*20ppts*	Upward adjustments:	*2*
Periodicity:	*3 months*	Downward adjustments:	*2*
Reset value:	*One-and-a-half times tolerance*	Average upward adjustment:	*30ppts*
		Average downward adjustment:	*-30ppts*
		Average allowance:	*100.5*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.00%	0.00%	0.00
2006/7	0.00%	0.00%	0.00%	0.00
2007/8	0.00%	-0.79%	-0.48%	-0.79
2008/9	0.00%	0.90%	0.55%	0.90
2009/10	0.00%	0.00%	0.00%	0.00
Total	*0.00%*	*0.02%*	*0.01%*	***0.11***

The introduction of a restriction on the size of allowance shifts introduces a new tension to the model. Configuration 1 was able to respond to the sharp rise in prices in one full adjustment and then reset to an appropriate final value. The set tolerance band width multiple is likely to result in either under- or over-adjustment to movements in the underlying index. This effect would be the same if the reset value was set as a percentage point increment rather than as being linked to the tolerance band width.

Configuration 3 reiterates the unwarranted restrictiveness of limiting the size of allowance adjustments. If the tolerance bands are narrowed to only 10 percentage points compared to 20 percentage points in configuration 2, the restrictiveness of the fixed reset values is exacerbated. This can be seen in Figure 7.13 and in the total number of adjustments counted in Table 7.15.

Figure 7.13: Configuration 3 for indexing the real steel price in GBP terms over DPCR4

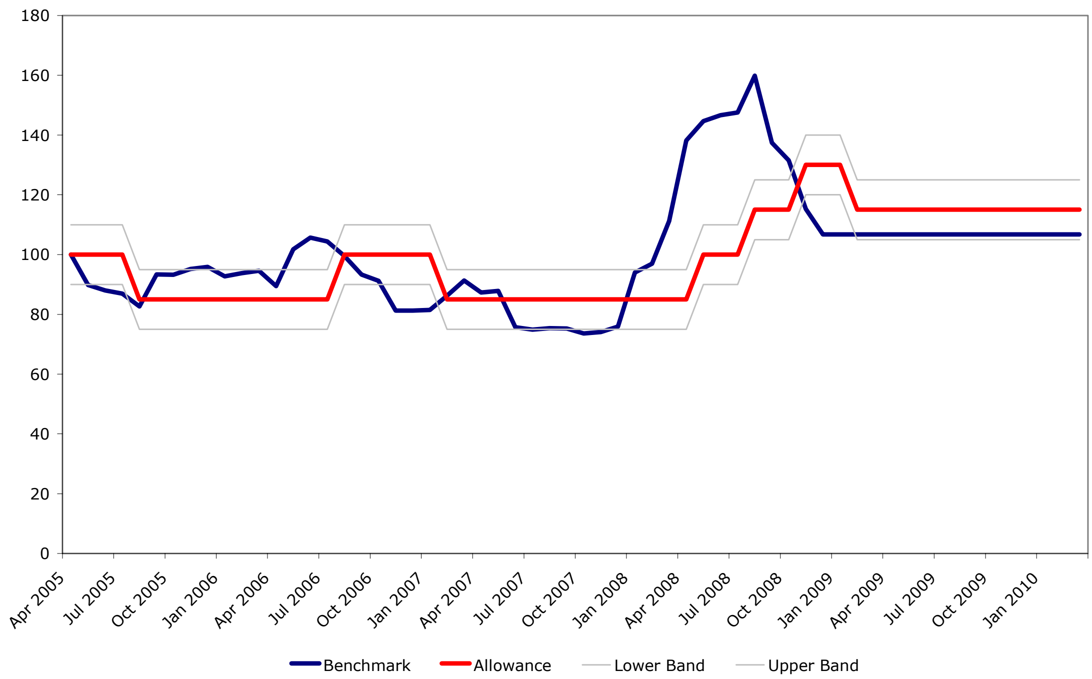

Table 7.13: Model settings and outputs for configuration 3 for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*7*
Tolerance:	*10ppts*	Upward adjustments:	*4*
Periodicity:	*3 months*	Downward adjustments:	*3*
Reset value:	*One-and-a-half times tolerance*	Average upward adjustment:	*15ppts*
		Average downward adjustment:	*-15ppts*
		Average allowance:	*99*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	-0.45%	-0.28%	-0.45
2006/7	0.00%	-0.34%	-0.21%	-0.34
2007/8	0.00%	-0.67%	-0.41%	-0.67
2008/9	0.00%	0.56%	0.35%	0.56
2009/10	0.00%	0.68%	0.42%	0.67
Total	*0.00%*	*-0.05%*	*-0.03%*	***-0.23***

This configuration illustrates the risk that these restrictions could lead to continual under-adjustment and hence the need for the allowance to reset more frequently; seven times here compared to three under steel configuration 1. If the margins or shift multiples were too large for price fluctuations, the allowance would be over-responsive, shifting large distances for sustained but minor breaches. If the margins or shift multiples were too small, it could take a long time to respond to rapid changes.

Steel configuration 4 investigates a further permutation of configuration 1.

Figure 7.14: Configuration 4 for indexing the real steel price in GBP terms over DPCR4

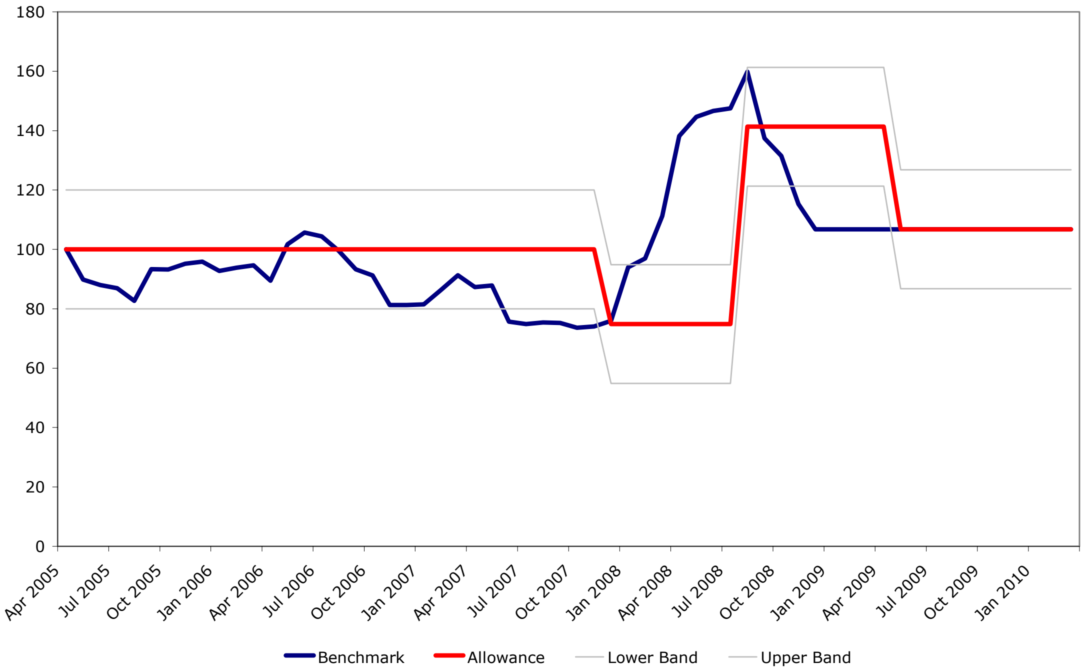

Table 7.14: Model settings and outputs for configuration 4 for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*3*
Tolerance:	*20ppts*	Upward adjustments:	*1*
Periodicity:	*6 months*	Downward adjustments:	*2*
Reset value:	*Breach period average*	Average upward adjustment:	*66.5ppts*
		Average downward adjustment:	*-29.9ppts*
		Average allowance:	*104.09*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.00%	0.00%	0.00
2006/7	0.00%	0.00%	0.00%	0.00
2007/8	0.00%	-0.38%	-0.23%	-0.38
2008/9	0.00%	0.86%	0.53%	0.86
2009/10	0.00%	0.43%	0.27%	0.43
Total	*0.00%*	*0.18%*	*0.11%*	***0.91***

Steel configuration 4 shows how increasing the time that the index must breach the tolerance bands can lead to unresponsive movements in the allowance. The allowance is only able to rise six months after the underlying price index increases, leaving the DNO worse off than under the current regime in 2007/8. It then takes some time to readjust to the post-peak level, allowing DNOs to able to take advantage of the mismatch, meaning that the DNO would have a capex allowance £0.91m larger over DPCR4 than under the current regime.

Steel configuration 5 is the final steel configuration explored in this section and shows how inappropriately small tolerance bands can lead to unnecessarily frequent adjustments.

Figure 7.15: Configuration 5 for indexing the steel price in GBP terms over DPCR4

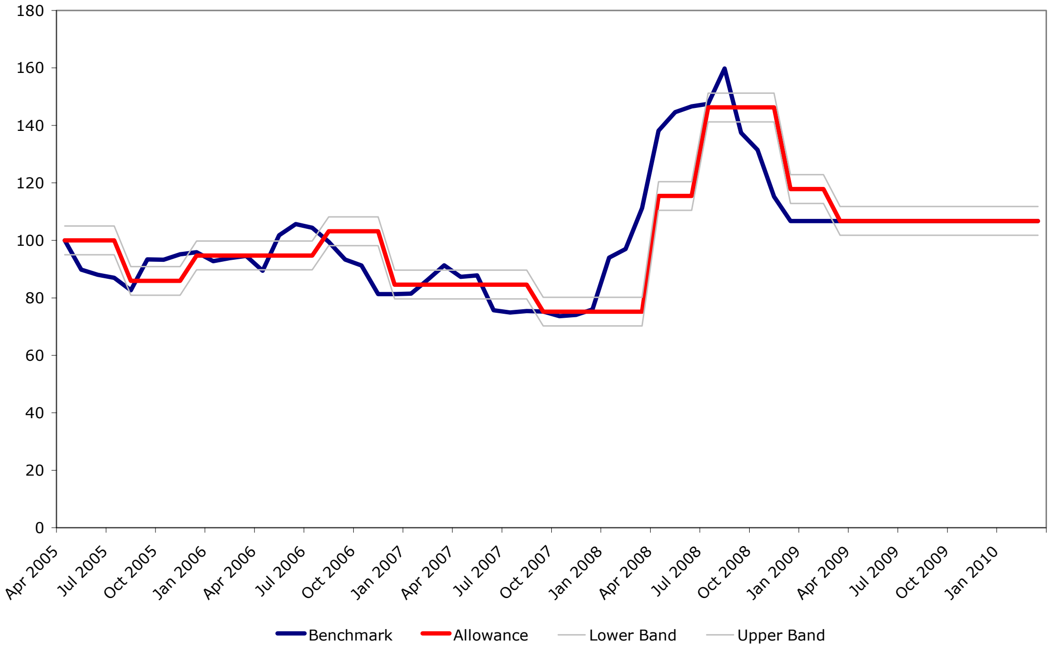

Table 7.15: Model settings and outputs for configuration 5 for indexing the real steel price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Steel price (Hot Rolled Coil) GBP*	Total number of adjustments:	*9*
Tolerance:	*5ppts*	Upward adjustments:	*4*
Periodicity:	*3 months*	Downward adjustments:	*5*
Reset value:	*Breach period average*	Average upward adjustment:	*22.1ppts*
		Average downward adjustment:	*-16.3ppts*
		Average allowance:	*100.35*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	-0.29%	-0.18%	-0.29
2006/7	0.00%	-0.26%	-0.16%	-0.26
2007/8	0.00%	-0.94%	-0.57%	-0.94
2008/9	0.00%	1.27%	0.78%	1.26
2009/10	0.00%	0.30%	0.19%	0.30
Total	*0.00%*	*0.01%*	*0.01%*	***0.07***

As can be seen in Table 7.115, small tolerance bands led to 9 readjustments in this period. It makes the index highly responsive to movements in the underlying index, but at the cost of increasing uncertainty. The number of adjustments can be reduced if the required breaching period is extended to 6 months. However this leads to a level of insensitivity similar to that seen under steel configuration 4.

7.5.2. Copper indexing

The lessons from copper indexation follow on closely from those for steel. As we do not know what type of movements each index will take over the next control period, the lessons learnt are not specific to the benchmark chosen. The historical data provides realistic scenarios for the trigger to deal with. The copper price data ends in February 2009, after which the scenario of 1.5% monthly growth is applied to simulate what might occur if the copper price rose quickly for the rest of the control period. As before, this is an illustration, not a prediction.

Copper configuration 1 provides the starting point for copper indexation. This sets 10% tolerance bands, changing after three months to the breaching average. The outputs are summarised in Figure 7.16 and Table 7.16 below.

Figure 7.16: Configuration 1 for indexing the real copper price in GBP terms over DPCR4

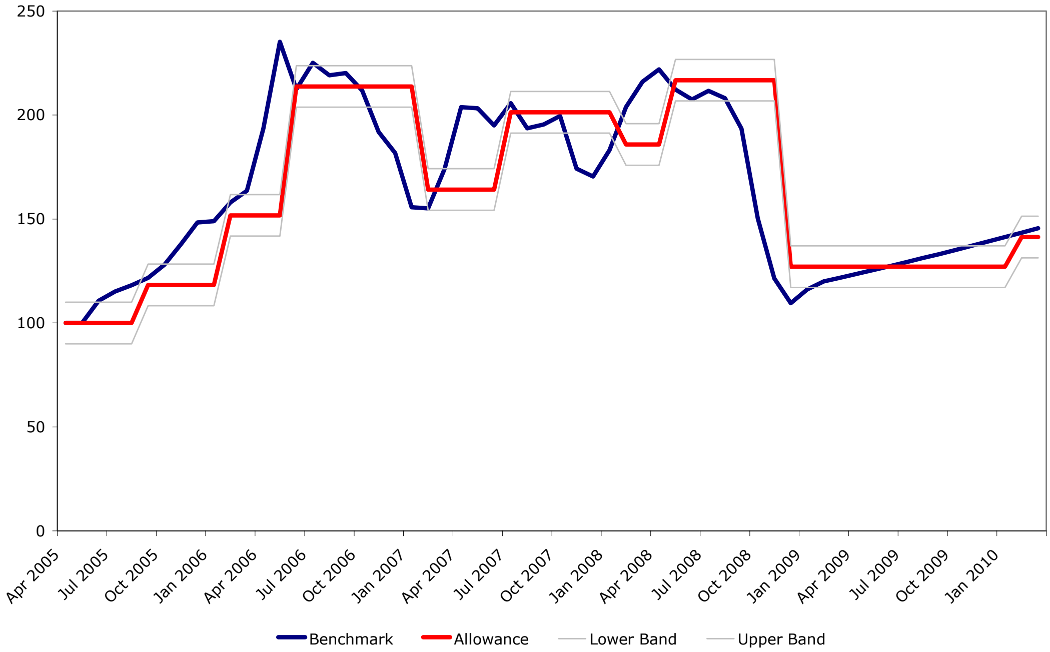

Table 7.16: Model settings and outputs for configuration 1 for indexing the real copper price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Copper Price GBP*	Total number of adjustments:	*9*
Tolerance:	*10ppts*	Upward adjustments:	*6*
Periodicity:	*3 months*	Downward adjustments:	*3*
Reset value:	*Breach period average*	Average upward adjustment:	*32.7ppts*
		Average downward adjustment:	*-51.6ppts*
		Average allowance:	*162.91*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.60%	0.37%	0.60
2006/7	0.00%	3.52%	2.15%	3.52
2007/8	0.00%	3.31%	2.02%	3.30
2008/9	0.00%	3.12%	1.91%	3.10
2009/10	0.00%	1.09%	0.67%	1.08
Total	*0.00%*	*2.33%*	*1.43%*	***11.60***

This first configuration shows that it is more challenging to actively respond to the movements in the copper price. There are nine adjustments under this mechanism but the benefits from doing so are larger than before. The representative DNO capex allowance would be £11.60m (2002/3 prices) larger under this mechanism in 2006/7 than under the current fixed regime. However, this configuration could be seen as being over-responsive to the movements in the copper price.

Copper configuration 2 reduces the number of adjustments from nine to four simply by increasing the number of months required outside the bands to six.

Figure 7.17: Configuration 2 for indexing the real copper price in GBP terms over DPCR4

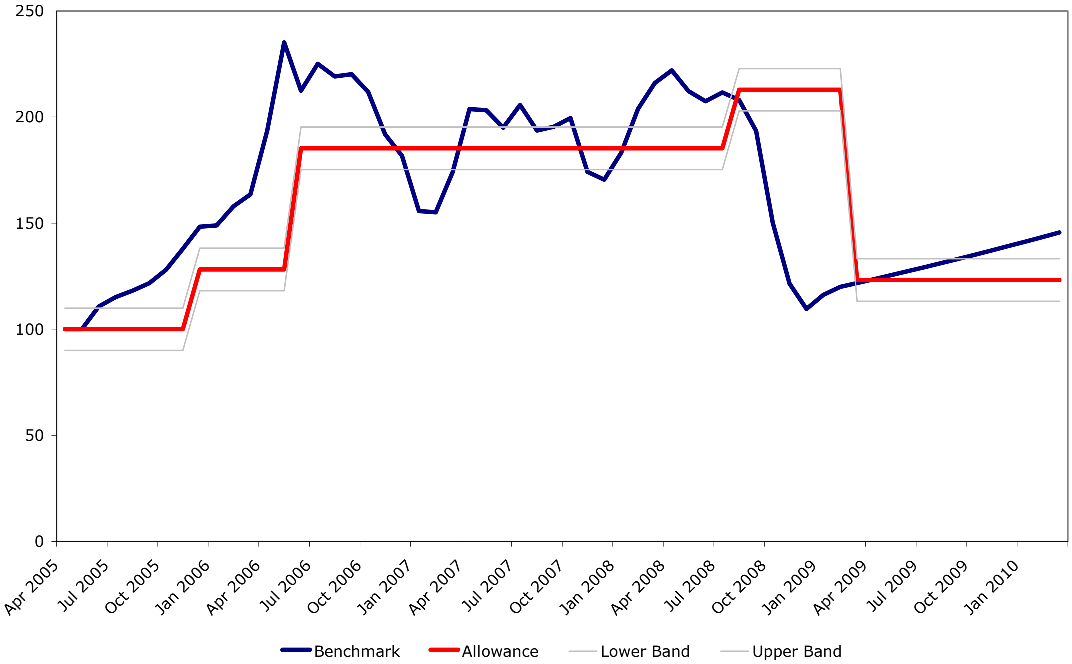

Table 7.17: Model settings and outputs for configuration 2 for indexing the real copper price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Copper Price GBP*	Total number of adjustments:	*4*
Tolerance:	*10ppts*	Upward adjustments:	*3*
Periodicity:	*6 months*	Downward adjustments:	*1*
Reset value:	*Breach period average*	Average upward adjustment:	*37.6ppts*
		Average downward adjustment:	*-89.7ppts*
		Average allowance:	*157.97*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.35%	0.21%	0.35
2006/7	0.00%	2.80%	1.71%	2.80
2007/8	0.00%	3.15%	1.93%	3.14
2008/9	0.00%	3.56%	2.18%	3.54
2009/10	0.00%	0.86%	0.53%	0.85
Total	*0.00%*	*2.14%*	*1.31%*	***10.69***

DNOs are not quite as well off under this mechanism as before, adding a slightly lower £10.69m to the representative capex allowance. However, the largest problem with this design is the long lags it has before it adjusts. These are particularly significant as the prices rapidly rise and fall.

Copper configuration 3 applies the same settings as under steel configuration 1.

Figure 7.18: Configuration 3 for indexing the real copper price in GBP terms over DPCR4

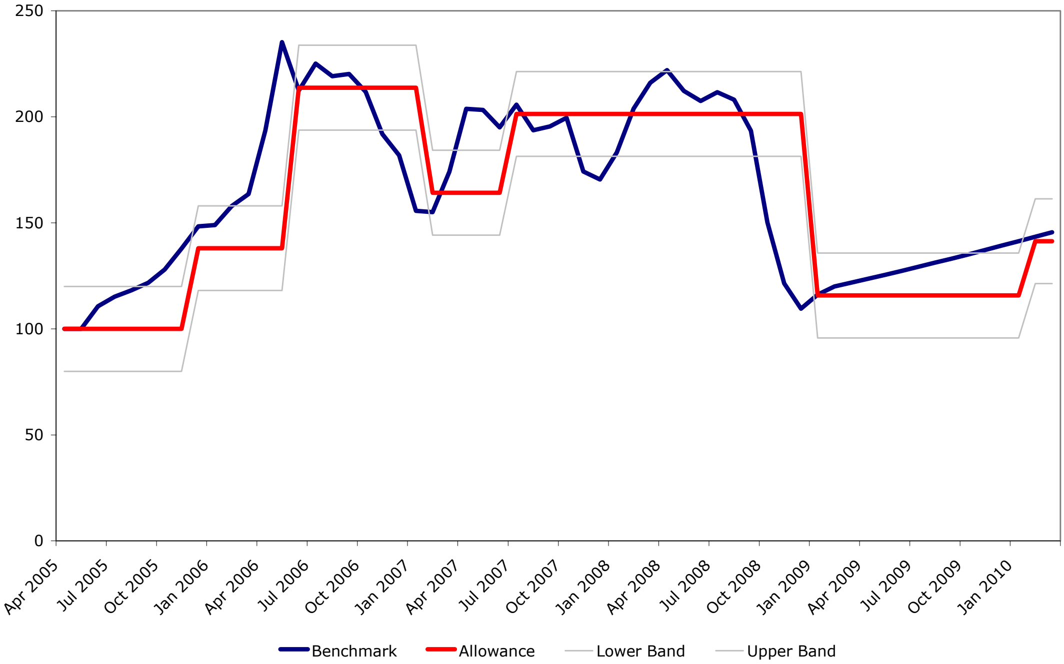

Table 7.18: Model settings and outputs for configuration 3 for indexing the copper price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Copper Price GBP*	Total number of adjustments:	*6*
Tolerance:	*20ppts*	Upward adjustments:	*4*
Periodicity:	*3 months*	Downward adjustments:	*2*
Reset value:	*Breach period average*	Average upward adjustment:	*44.1ppts*
		Average downward adjustment:	*-67.6ppts*
		Average allowance:	*159.5*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.47%	0.29%	0.47
2006/7	0.00%	3.44%	2.10%	3.43
2007/8	0.00%	3.41%	2.08%	3.39
2008/9	0.00%	2.96%	1.81%	2.94
2009/10	0.00%	0.74%	0.46%	0.74
Total	*0.00%*	*2.20%*	*1.35%*	***10.98***

This again appears to be a reasonable configuration. It responds well to large changes without unacceptable lags or unnecessary fluctuations. Shifting by multiples of the tolerance margins is also unresponsive and restrictive in copper configuration 4.

Figure 7.19: Configuration 4 for indexing the real copper price in GBP terms over DPCR4

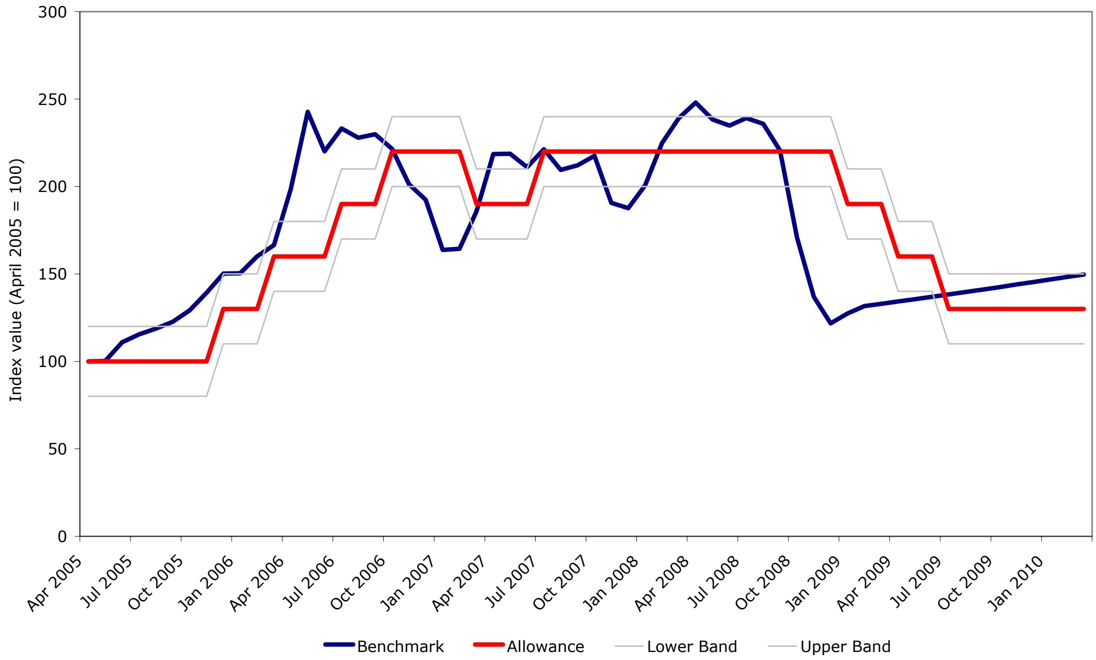

Table 7.19: Model settings and outputs for configuration 4 for indexing the real copper price in GBP terms

Model Description		Outcomes	DPCR4
Benchmark:	*Real Copper Price GBP*	Real Copper Price GBP	*9*
Tolerance:	*20ppts*	Upward adjustments:	*5*
Periodicity:	*3 months*	Downward adjustments:	*4*
Reset value:	*One-and-a-half times tolerance*	One-and-a-half times tolerance	*30ppts*
		Average downward adjustment:	*-30ppts*
		Average allowance:	*164.5*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.37%	0.23%	0.37
2006/7	0.00%	3.15%	1.92%	3.14
2007/8	0.00%	3.33%	2.03%	3.32
2008/9	0.00%	3.79%	2.33%	3.77
2009/10	0.00%	1.29%	0.80%	1.29
Total	*0.00%*	*2.39%*	*1.46%*	***11.89***

This configuration leads to the representative DNO capex allowance being £11.89m larger than under the current regime, and slightly more than under the other specifications above. However, this figure is not always a sign of health and is due here to the poor ability to deal with the rapid fall in prices in early 2009.

7.5.3. BEAMA Electrical Equipment Index

The final benchmark index investigated in the model is the BEAMA Electrical Equipment Index. The series currently in the model ends in April 2008. The simple illustrative scenario of 0.5% monthly negative growth is applied for the rest of the control period.

The first and only configuration shown in this section takes the parameter values used in copper configuration 1.

Figure 7.20: Configuration 1 for indexing the real BEAMA Electrical Equipment index over DPCR4

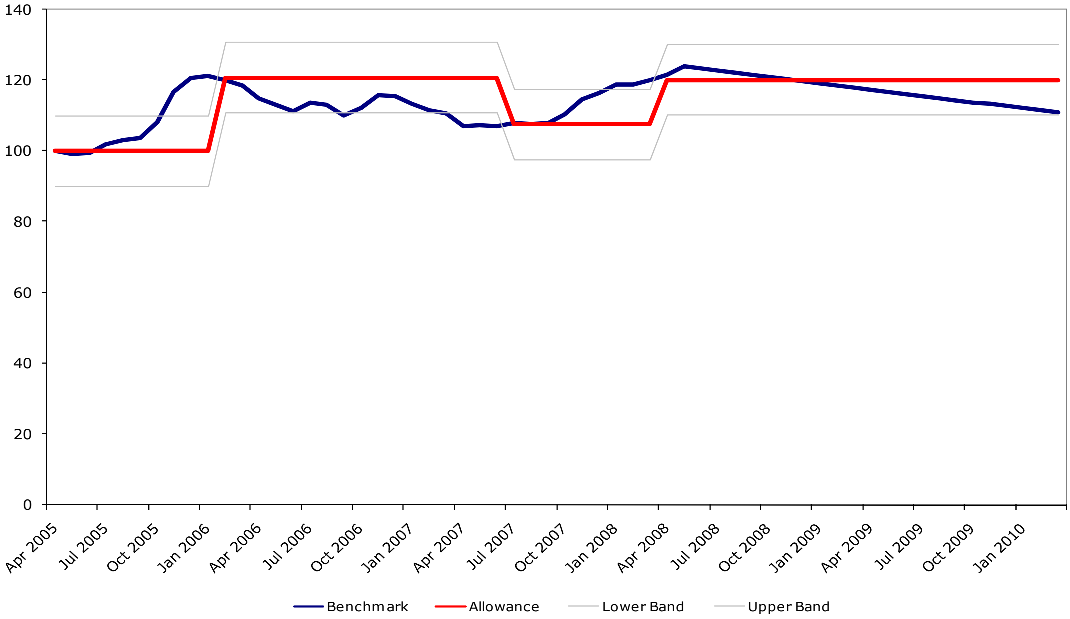

Table 7.20: Model settings and outputs for configuration 1 for the real BEAMA Electrical Equipment index

Model Description		Outcomes	DPCR4
Benchmark:	*Real BEAMA Electrical Equipment index*	Total number of adjustments:	*3*
Tolerance:	*10ppts*	Upward adjustments:	*2*
Periodicity:	*3 months*	Downward adjustments:	*1*
Reset value:	*Breach period average*	Average upward adjustment:	*16.7ppts*
		Average downward adjustment:	*-13.2ppts*
		Average allowance:	*115.08*

Impact of trigger configuration relative to current regime

DPCR4	Opex allowance	Capex allowance	Total Allowance	Net impact of Indexation introduction (£m 2002/3)
2005/6	0.00%	0.60%	0.37%	0.60
2006/7	0.00%	3.62%	2.21%	3.62
2007/8	0.00%	1.90%	1.16%	1.89
2008/9	0.00%	3.53%	2.17%	3.52
2009/10	0.00%	3.53%	2.18%	3.51
Total	*0.00%*	*2.64%*	*1.61%*	***13.14***

The portfolio effect within this composite index means that although the value does shift around, its movements are moderated compared to other benchmark indices. The lessons for steel and copper translate well to this index. The smaller movements appear to make configuration less critical. However, these movements command larger portions of allowances, with just three shifts increasing the capex allowance by more than each of the previous specifications, but with very few allowance changes being triggered.

7.6. Revenue impacts

The net impact of each indexation mechanism compared to the current regime can be calculated in the model assuming that costs incurred would be the same under both arrangements. The current regime is equivalent to a straight line index set at 100 for the whole of the control period. This allowance does change each year, but only by the amounts set at the beginning of the price control period.

The differences in capex allowances between these regimes are referred to as the 'net impact of indexation' in each of the output tables above, where the monthly figures have been summed to show their annual impact over each year in the stylised control period. DNOs would have gained under all but one of the worked examples above. This is largely the result of prices having risen significantly even after removing the effect of RPI inflation. However, had prices fallen, DNOs' capex allowances would have decreased, passing on the benefits to consumers.

Although this is an important number, it is not the one that should be maximised. It is more important that the allowance reflects the underlying benchmark index, but with a minimal number of adjustments. The aim is for the DNO to neither gain nor lose much on the indexed portion of expenditure. An index which shifts frequently in quick response to changes will lead to a net revenue from the indexed proportion of their cost allowances closer to zero than would have occurred under the existing fixed allowance. This should allow DNOs to cover their costs when commodity markets move against them. However, this benefit would be given to them at the cost of losing a portion of their allowance when prices fall.

7.7. Implementation issues

If an indexation/ trigger mechanism were to be implemented there are some issues that would need to be finalised. These include:

- the final choice of indices – our recommendation is to take the individual specific indices that have been identified as appropriate for indexation (steel and copper) and use these. Of course, no matter which index is used allowance will need to be made for the speed of the delivery of the index – if the index is only provided three months after the valuation date then effectively a three month lag is being introduced;[52]
- the appropriate basis – we recommend using two separate mechanisms rather than a weighted index, although adding some slight complexity to price control, it does allow parameter choices that are appropriate to the input rather than average ones to be used; and
- the final parameter choices for the mechanisms – aspects of this will depend on whether the previous recommendations are accepted. We would, however, recommend that logging-up is used to minimise the within-price control period volatility of revenues and prices.

Ofgem will also need to design a monitoring tool to implement the indexation during the price control period. The basic front-end of the model would be the same as that used in the CEPA model – although the choices about the parameters would be made once and then fixed. What would then be needed is a reconciliation aspect to the model which captured the opex and capex allowances and the adjustments caused by the indexation during the price control period. This model ought to be published annually to ensure transparency and clarity about what adjustments will be captured through the logging-up process.

[52] This is a problem that Ofgem already faces with respect to inflation adjustments. Any solution will involve accepting some lag – for some indices the lag may be very short (say one day for financial data or commodity trade data) while other may have much longer lags, especially where official statistics are being prepared and are subject to possible revision. However, provided clear rules are created this should not pose a problem to designing a mechanism.

ANNEX 1 – TERMS OF REFERENCE

CEPA was contracted by Ofgem to carry out work on input prices and volumes in order to assist its review of DNOs' business plans as part of DPCR5. The work was spilt into three work streams:

- **Input price assumptions for DPCR5** – CEPA was asked to review and critique reports by First Economics and NERA which develop estimates for DNOs' input price inflation, and to develop our own forecasts of input price inflation, which would focus on those areas where there were concerns about the robustness of the analysis undertaken by First Economics and/ or NERA. Forecasts were required up to 2014/15 for:
    - direct labour costs associated with electricity distribution activities;
    - contracted labour costs associated with electricity distribution activities;
    - cables and overhead conductors;
    - transfomers and switchgears;
    - civils including access routes, site preparation, operational buildings (including substation housings) and associated infrastructure; and
    - other input costs including rent, insurance, transport and IT.
- **Volume forecasts for DPCR5** – Similarly to the first work stream, we were asked to review and critique two papers prepared by Oxera which look at factors affecting the number of electricity meters and electricity demand. We were then asked to come up with our own forecasts where shortcomings are identified with Oxera's estimates. Ofgem sought forecasts up to 2014/15 on:
    - economic growth and employment levels (if possible by DNO region) how they may affect electricity demand; and
    - the number of new connections for domestic, industrial and commercial consumer (if possible by DNO region).
- **Methods to incorporate indexation of real input prices into allowed revenue** – Ofgem sought advice on how an indexation mechanism for input prices may be used in practice. Ofgem sought answers to two key questions:
    - what part of input costs is to be indexed so that it is relevant for DNOs?
    - how will the indexation mechanism be implemented in practice (i.e. full indexation or using a trigger, instantaneous adjustment or logging up/ down) so that it is easily incorporated into the licence condition?

ANNEX 2 – COMPARISONS OF STYLISED DNOS

The tables in this annex show the split of costs between different components to derive our stylised DNO and the stylised DNO used by First Economics.

Tables A2.1 to A2.3 show our split for operational, capital and total costs.

Table A2.1: Opex (%)

Input	Proportion of costs
General labour	45
Contractor labour (opex)	35
Materials – general	10
Other	10

Table A2.2: Capex (%)

Input	Proportion of costs
General labour costs	50
Specialized labour costs	15
Materials – general	10
Materials – specialized	15
Equipment/ Plant costs	10

Table A2.3: Overall (%)

Input	Proportion of costs
General labour costs	50
Contractor labour (opex)	20
Contractor labour (capex)	5
Materials – general	10
Materials – specialized	5
Equipment/ Plant costs	5
Other	5

Tables A2.4 to A2.6 show the split of costs for First Economics' stylised DNO for opex, capex and overall costs.

Table A2.4: Opex (%)

Input	**% of 2007/ 08 Expenditure**
Labour – general	50
Labour – electrical engineers/ specialists	25
Materials	10
Rent	5
Insurance	2.5
Transport	2.5
IT	2.5
Other	2.5

Table A2.5: Capex (%)

Input	**% of 2007/ 08 Expenditure**
Labour – general	30
Labour – skilled infrastructure specialists	30
Materials – electrical	15
Materials – general equipment	10
Equipment/ plant	10
Other	5

Table A2.6: Overall (%)

Input	**% of 2007/ 08 Expenditure**
Labour – general	30
Labour – skilled infrastructure specialists	30
Materials – electrical	15
Materials – general construction	10
Equipment	10
Other	5

ANNEX 3 – EXPLANATION OF FORECASTING APPROACH

The forecasting approach that we have used in this report is based around the assumed relationship between the year on year % growth rate a given index and the year on year % growth rate of RPI. As explained in detail in section 2 we have developed three separate scenarios for RPI growth over DPCR5, which are based on the GDP scenarios for the UK economy. Each of the three scenarios provides a range of forecasts for RPI growth over DPCR5.

We use the RPI growth forecasts over DPCR5, to provide a forecast of the given index using the simple linear regression equation:

The equation used for the forecast is a+bx, where:

$$a = \bar{y} - b\bar{x}$$

and:

$$b = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2}$$

Where x represents the known RPI values and y represents values from the index. Effectively the forecast value produced for the given index for each year is calculated based on the historical relationship between RPI and the index. We have used the relationship over the last economic cycle as defined by HM Treasury 1997/ 98 to 2006/ 07 between the index and RPI and the 'known' values of RPI as defined by the three scenarios.[53][54] Though the forecasts for the DNO's labour costs (both for the general labour force and for the DNO's specialized labour) are based on the full average earnings dataset, which goes back to 1990.

Ideally we would want to look at the relationship between the two variables over three or at least two business cycles, particularly as we note in the report, because the last economic cycle has witnessed relatively high growth and low inflation – though it is also worth noting that despite the overall macroeconomic stability enjoyed over the previous economic cycle there has been significant level of instability in a number of important markets, particularly a wide level of variation in commodity prices.

Given the current level of economic uncertainty, the complex nature of the economic indicators being analyzed, and the length of the forecast time period the results of the forecasting approach are subject to some uncertainty particularly for the materials and equipment/ plant forecasts. Furthermore, while the relationship between the wages for the DNO's workforce and RPI inflation is well established, as many of the prices of the mix of goods contained in materials and equipment/ plant are set outside the UK the relationship with RPI will be more problematic. However, the approach used is

[53] The forecast for general wage growth is developed by using data from 1990 – 2007/08. This is partly because of the availability of additional data, but also because earnings data has been relatively benign since 1990.

[54] See HM Treasury (2008) 'Evidence on the Economic Cycle'.

transparent and has been applied consistently. Furthermore, by using the scenario driven approach the forecasts can be updated as additional information about the outcomes for the UK economy become available.

ANNEX 4 – FORECASTS FOR MATERIALS AND SERVICES

In this annex we produce forecasts for the following materials and services:

- transformers and switchgears;
- civils and overhead cables; and
- other input costs including rent, insurance, transport and IT.

Producing forecasts for these inputs over such a long time horizon can be problematic given the significant degree of variability that has occurred in the relevant markets over the economic cycle. When we then consider the significant uncertainty about the course for the UK economy over the medium-term we can see how difficult it is to provide forecasts with confidence at any level of granularity. We would therefore place a significantly greater weight on the more high level forecasts presented in section 4 of this report.

In the following tables we present forecasts for the inputs stated above. The forecasts that we present are of an illustrative nature and generally represent what might occur if the inputs exhibit a similar price growth to RPI inflation relationship as experienced over the previous economic cycle.

The methodology to produce the forecasts is as follows:

- The forecasts for commercial rent are based on the RICS's commercial property forecast and our judgement based on analysis of recent price data in the commercial rental market and the potential impact of the current economic downturn.[55]
- The forecasts for insurance, transport and IT are developed using the same approach as in the main report, i.e. we choose a relevant index and produce a forecast based on the RPI scenarios. For each of these forecasts, we have relied on indices produced by the ONS similar to those used in the First Economics report. We recognise that this is not ideal but there is a lack of available indices for these sectors.
- The forecasts for transformers, switchgears, overhead cables and civils are based on an estimate provided by an engineer of the factor content of each of the inputs, shown in table A4.1 below.

[55] Royal Institute of Chartered Surveyors (2008) 'Commercial property forecast – December 2008'.

Table A4.1: Factor content for transformers, switchgears, and civils (%)

Input	Copper	Aluminium	Steel	Miscellaneous materials	Labour
Transformers	30	0	20	5	45
Switchgears	15	10	15	10	50
Overhead cables	0	40	15	5	40
Civils	0	0	10	20	70

Source: CEPA analysis

Based on the factor content of each of the inputs we produce forecasts using the available data from forward curves downloaded from Bloomberg for future price growth in copper, steel, and aluminium, and the forecasts for the wage growth forecasts for the DNO's contracted labour presented in section 4 of this report.

Tables A4.2 to A4.4 present the results of our forecasts in real terms. As stated above these forecasts provide an illustration of the potential input price growth in real terms over DPCR5. We would again caution that producing forecasts for goods and services in markets which have experienced significant volatility during a period of pronounced economic uncertainty will produce results that should be interpreted with care. The main messages coming from the results presented in the tables below are as follows:

- **Rent:** In both scenarios 1 and 2 we forecast commercial rental prices to fall in real terms, while we forecast only marginal growth in the price of commercial rent over DCPR5. Given the significant growth that has occurred in the property market over the last economic cycle we would expect the sector to experience lower price growth than the rest of the economy over the medium-term.
- **Insurance:** Given the problems experienced in the global commercial insurance market, the overall message to take from the three insurance forecasts is that the price of insurance premia faced by the DNOs will potentially experience limited real price growth over DPCR5. We would caution that the forecasts for price growth for commercial insurance premium have been developed using the ONS household insurance premium data, which may not be the most effect proxy for the DNO's insurance costs, the analysis is restricted by a lack of relevant indices with enough historical data.
- **Transport:** The forecasts show quite a varied trend for input price inflation for the DNO's transport costs over DCPR5.
- **IT:** All three scenarios show a real price decline for the DNO's IT costs over DCPR5. Despite the uncertainty in the results the forecasts that we have produced are broadly in line with First Economics (December 2008) forecasts.
- **Materials**: (transformers, switchgears, overhead conductors, civils): Our forecasts for the DNO's specific materials generally show limited real price growth over DCPR5, with the forecasts broadly showing in the region of

between 1.4% real price growth and a -0.4% real price decline for the selected materials over DCPR5. These forecasts are thus, with the exception of a few outliers, approximately within the range of the more high level materials forecasts presented in Section 4 and the forecast presented by NERA. It is important to note that these forecasts include forecasts for Copper, Steel, and Aluminium all of which have exhibited a significant level of price volatility in recent years.

Table A4.2: Forecasts for Scenario 1 (real terms % year on year change)

	Rent	**Insurance**	**Transport**	**IT**	**Transformers**	**Switchgears**	**Overhead conductors**	**Civils**
2008/09	-12.0	6.4	2.9	-1.5	-28.4	-22.7	-28.2	-6.7
2009/10	-6.0	10.9	4.0	-0.8	2.3	2.3	0.2	-0.3
2010/11	-5.7	0.2	-1.5	-2.4	-0.2	0.8	-0.3	1.1
2011/12	-3.4	-1.4	-3.5	-2.7	-0.6	0.4	-0.4	1.3
2012/13	-0.5	-0.4	-3.5	-2.5	-0.5	0.4	-0.4	1.2
2013/14	-0.4	-0.1	-1.9	-2.5	-0.5	0.4	-0.4	1.1
2014/15	2.2	0.0	-2.5	-2.5	-0.7	0.2	-0.4	1.1
Average over forecast period	**-3.7**	**2.2**	**-0.9**	**-2.1**	**-4.1**	**-2.6**	**-4.3**	**-0.2**
Average *over 2010/11 – 2014/15*	**-1.6**	**-0.3**	**-2.6**	**-2.5**	**-0.5**	**0.4**	**-0.4**	**1.2**

Source: CEPA analysis

Table A4.3: Forecasts for Scenario 2 (real terms % year on year change)

	Rent	**Insurance**	**Transport**	**IT**	**Transformers**	**Switchgears**	**Overhead conductors**	**Civils**
2008/09	-12.0	6.4	2.9	-1.5	-29.1	-22.9	-29.1	0.0
2009/10	-5.7	11.7	4.7	-0.7	2.9	2.3	-0.1	-0.7
2010/11	-3.9	4.4	2.7	-1.8	-0.4	1.8	-1.2	0.2
2011/12	-2.5	0.8	1.3	-2.3	-2.0	0.8	-1.8	0.7
2012/13	-1.5	-2.8	-0.4	-2.9	-3.7	-0.6	-2.4	1.1
2013/14	0.6	-3.6	-0.7	-3.0	-4.1	-0.9	-2.5	1.2
2014/15	0.3	-4.2	-1.0	-3.1	-4.7	-1.4	-2.6	1.3
Average over forecast period	**-3.5**	**1.8**	**1.4**	**-2.2**	**-5.9**	**-3.0**	**-5.7**	**0.5**
Average *over 2010/11 – 2014/15*	**-1.4**	**-1.1**	**0.4**	**-2.6**	**-3.0**	**0.0**	**-2.1**	**0.9**

Source: CEPA analysis

Table A4.4: Forecasts for Scenario 2 (real terms % year on year change)

	Rent	**Insurance**	**Transport**	**IT**	**Transformers**	**Switchgears**	**Overhead conductors**	**Civils**
2008/09	-12.0	5.4	2.9	-1.5	-29.2	-22.9	-28.6	-7.4
2009/10	-5.3	11.1	5.0	-0.6	1.3	2.5	-0.1	-1.2
2010/11	-0.5	6.8	5.6	-0.7	1.2	4.4	-0.2	-1.1
2011/12	1.2	3.5	4.7	-1.1	0.7	4.1	-0.3	-0.7
2012/13	-0.1	0.1	3.8	-1.5	0.2	3.8	-0.5	-0.4
2013/14	1.5	-1.2	3.0	-1.8	-0.1	3.1	-0.5	-0.1
2014/15	1.0	-2.1	2.6	-2.0	-0.5	2.6	-0.6	0.0
Average over forecast period	**-2.0**	**3.4**	**4.0**	**-1.3**	**-3.8**	**-0.3**	**-4.4**	**-1.5**
Average *over 2010/11 – 2014/15*	**0.6**	**1.4**	**4.0**	**-1.4**	**0.3**	**3.6**	**-0.4**	**-0.4**

Source: CEPA analysis