The Influence of UK Energy Security and Peak Oil as Drivers Impacting on WCC Services and Activities

Final Report

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MSc Business Analytics and Consulting

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CAVEAT

Warwickshire County Council is happy to share this report in good faith with its partners, outside bodies and individuals in order to help raise awareness in this increasingly important area. WCC's overall objective is to better understand the issues and support future business planning in a changing world.

The Council does not take responsibility for the accuracy and quality of the data on which the report is based, and it should be noted that the scenarios suggesting higher energy prices are there to stimulate thinking - and are not predictions by the report authors or WCC. They are however based around extensive work by others. It would be of interest to hear if other Local Authorities are considering these issues, although we are unlikely to be able to get involved in significant correspondence due to work priorities. Thank you: theenergyteam@warwickshire.gov.uk

EXECUTIVE SUMMARY

1. Purpose - This study analyses the influence of UK Energy Security and Peak Oil as drivers impacting on Warwickshire County Council (WCC) activities. The questions addressed by the study are what UK Energy Security and Peak Oil are all about, why they matter, how they impact on WCC, and what the authority's next steps should be.

2. Methodology - Thorough research into the topics of UK Energy Security and Peak Oil builds the foundation of the study. Awareness within the organisation was raised most notably in two workshops, but also through continuous engagement with people from a range of service areas. The analysis of the implications for WCC is based on financial as well as qualitative data collected from WCC staff and supply chain companies.

3. Energy is of huge importance for our overall prosperity - Energy and fossil fuels are present in almost all economic and many societal processes. The astonishing energy density of the fossil fuels is one of the dominating factors in the advancement of our civilisation over the last century.

UK Energy Security and Peak Oil are real threats - There is some debate about the WHENs and HOWs, but not about the IF. These challenges will come and will lead to higher energy prices and possibly shortages of supply. The topics are gaining attention in the private sector - companies like Lloyds, Virgin Group, Stagecoach, Scottish and Southern Energy and many others are aware, warn about these issues, and prepare for them.

4. WCC Services are significantly affected - Our results show that WCC Services are affected by these threats through increased costs, changes in demand, impacts on staff, and possibly shortages. Some areas are more severely affected than others and the nature of the impact varies, but all of the areas analysed are exposed to these risks in some way.

5. We strongly recommend pursuing this topic further, both by investigating in more detail as well as by taking action now - There is a lot that can be done to soften the impact. But since these measures have long lead times, action should be started now. Objectives that need to be pursued are: Behavioural Change, Increased Energy Efficiency, Increased Investment in Renewable Energies, Mitigating the Impact on Staff, Managing Demand for Services, and Reducing Risk of Shortages.

6. WCC has the opportunity to get to grips with the issues early - The drastic changes brought about by UK Energy Security and Peak Oil bring with them enormous opportunities for those who confront them early and decisively. For instance, there are substantial synergies with de-carbonisation efforts. WCC has the chance to work with others to explore the implications, understand risks and develop coping strategies.

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1 INTRODUCTION

1.1 OVERVIEW

1.1.1 This report outlines an analysis of the influence of UK Energy Security and Peak Oil as drivers impacting on Warwickshire County Council (WCC) service delivery. Christian Kurtenbach and Pedro Ramos, who are both MSc students at Warwick Business School (WBS), have conducted the project with support from Martin Kunc as academic supervisor. Jonathan Horsfield from WCC's Resource Directorate initiated the project.

1.1.2 UK Energy Security and Peak Oil are relatively new topics for most organisations, but are believed to present us with unprecedented challenges. This project attempts to answer the following questions:

- What are the UK Energy Security and Peak Oil issues?
- Why are these issues relevant?
- How do they impact on WCC service delivery? Including:
  - WCC's financial situation
  - Any qualitative impacts
  - WCC's supply chain
- What can WCC do to mitigate these impacts?

1.1.3 In the remainder of **Chapter 1**, we will explain the limitations of the study, give some background information on UK Energy Security and Peak Oil, and then review the objectives of the project. **Chapter 2** will show what work has been carried out and how. Thereafter, we will present the first part of our findings in **Chapter 3**. This will start with our conclusions about UK Energy Security and Peak Oil, including the question of why these topics are relevant. The next section will then deal with the general influence of these challenges on four areas relevant to WCC: *Power*, *Heating*, *Transport*, and *Materials*. In **Chapter 4**, each service area that has been part of the study will be analysed in detail, presenting financial and qualitative implications, indicative mitigation options and recommendations. We also briefly comment on the impacts on staff travel and supply chain companies in this chapter. **Chapter 5** shows our recommendations, including both further research needed and actions to take in the short term. The main body of the report ends with closing remarks in **Chapter 6**, but more detail is provided in the **Technical Appendices**.

1.2 LIMITATIONS

1.2.1 Like most studies of such scope, this one, too, suffers from some limitations. Reduced data availability forced us to focus more on qualitative impacts. We now lean more heavily on statements made by those involved in service delivery, by industry experts, and WCC suppliers.

1.2.2 Where we did use quantitative data, we often had to work with indicative figures and missing data points. We comment on data quality in each of the calculations in the Appendix. Nevertheless, the calculations made cannot be used as a basis of financial investment decisions. Rather, they should be seen as providing evidence about a challenge.

1.2.3 The project focused on UK Energy Security and Peak Oil as external drivers. We acknowledge that the ongoing efforts to de-carbonise both corporate activities and the economy are related to this analysis, but as such they do not form part of the project.

1.3 BACKGROUND

1.3.1 Energy and oil consumption are dominating factors in our prosperity. The energy density of oil and other fossil fuels is so

Did you know?

1 barrel of oil holds the **energy content** of 2,000 to 14,000 hours of **human labour** or 1 to 7 working years (depending on the type of work). On average, **every** British citizen consumes 25 barrels of oil equivalent each year, which corresponds to **25 to 175 people** working for him or her all-year round - are these the legendary shoe-making leprechauns?

enormous that they played a major role in the advancement of our civilisation over the last 100 years. Although the developed world managed to decrease the energy needed for every £ of GDP produced, we are still consuming well over twice as much energy per capita in the UK than in China[1]. As the box[2] shows, fossil fuels enable us to let machines do a huge part of the work that in the past we would have done ourselves or with the help of animals or would not even have been able to do (e.g. flying).

1.3.2 In recent years geo-political, societal, and economic events resulted in an increasing awareness for resource depletion and in particular the phenomenon of **Peak Oil**. According to this phenomenon, global oil production rates will peak and then go into terminal decline when about half of all available reserves have been depleted. Growth of notional demand for oil, driven by developing countries such as China or India, subsidised oil in the Middle East and population growth in general, is not expected to slow down anytime soon. The resulting gap to supply would cause oil prices to rise significantly. Forecasts as to when the peak in global oil production will occur vary from 'already in 2006' to 'not before 2030', but most experts agree that sometime between 2010 and 2020 is most likely[3]. Steeply rising oil prices have obvious implications for power, heat generation, transport, the cost of petrochemicals, and hence impact on the entire economy.

> "We are running the risk of another oil crisis when demand outstrips supply around 2014 or 2015. There won't be enough oil and gas by the middle of the decade."
>
> **Christophe de Margerie, CEO of Total, Sept 2009**

1.3.3 Coinciding with this challenge, the UK is facing a so-called electricity '**power crunch**' as all but one of its nuclear plants are due to shut down due to ageing during the next six years, while all the remaining coal power plants face closure as a result of anti pollution regulations. As the cheapest form of generation gas powered stations may well replace a sizeable part of this capacity unless the UK increases subsidies for the more expensive nuclear, renewable and the new carbon capture and storage technologies. Since North Sea gas production is in decline this will result in increasing gas imports, making the UK more vulnerable to geo-political disturbances and pricing in the global gas markets.

1.4 OBJECTIVES

1.4.1 The original objectives of the study (Figure 1 below) changed in the course of the project due to the limitations described above. The accuracy of the existing data did not allow assessing the nature and rate of investment as originally planned. Special focus is now given to recommendations and future work.

1. Raise general awareness within WCC, and other public sector bodies, of issues not yet on institutional and public horizons
2a. Assess potential impacts on selected service areas with particular reference to heat, power and transportation costs
2b. …and including indirect impacts through supply chain companies and their pricing
3a. Have those involved in service delivery assess the impact of such price changes on their client's lives / activities
3b. …and in consequence the potential for changes in the demand for WCC services
4. Use findings to assess what areas are most vulnerable and require further investigation.
5. Recommend
- Further research needed
- Actions to take

Figure 1: Objectives of the project

2 METHODOLOGY

2.1 STAGE 1 - RESEARCH

2.1.1 In order to gain a detailed understanding of UK Energy Security and Peak Oil, their drivers and especially their socio-economic effects, initial and ongoing research was carried out.

2.1.2 Information was gathered from a wide range of sources, including academia, industry associations, national and local authorities, corporations and consultancies. The most relevant information retrieved during the process is part of the next chapter where both sets of issues are explained in detail.

2.2 STAGE 2 - RANGE OF SERVICES

2.2.1 The service areas analysed in this project were defined in cooperation with Jonathan Horsfield. The decision was based on the expected vulnerability of specific areas and on the likelihood of engagement during the limited time frame.

2.3 STAGE 3 - RAISING AWARENESS

2.3.1 As one of the key outcomes of the project, it was our clear objective throughout the process to achieve stakeholder awareness and gain active participation. We devoted constant attention to this topic. The most visible outputs of the stage are highlighted below.

2.3.2 **"Workshop to Discuss Implications of Energy Security and Peak Oil for WCC"**[4] - Both workshops conducted on July 19th and 22th comprised a first part with a presentation on UK Energy Security and Peak Oil and a second to discuss the implications and mitigations of the problem.

On July 19th, with an audience of 11 representatives from 6 different areas, the second part included:

- A mapping exercise where participants were asked to generate, rank and link implications for their areas of service and WCC
- A mitigation exercise where each participant first identified 3 possible solutions and further discussed in consecutively bigger groups narrowing the options to a final list of 9.

On July 22th, with an audience of 4 participants including 3 representatives of WCC County Highways and one from Carillion plc, the second part was shortened to a questionnaire.

2.4 STAGE 4 - DATA COLLECTION AND ANALYSIS

2.4.1 **Financial Data: WCC** - The financial data used in the analysis of WCC vulnerability was gathered using four main sources: Bill Johnson, Energy Manager, with information on electricity, gas and oil consumed by each building; Sandra Dean, Budget Planning Officer, with information on directorate budgets; and Financial Managers responsible by each of the analysed areas with information on historical spending; Staff from within the analysed areas with area-specific data such as staff mileage.

2.4.2 **Financial Data: Supply chain** - Due to lack of information on the supply chain costs, the analysis uses industry data as its main source. Where not available the implications are analysed in qualitative terms.

2.4.3 **Qualitative Data** - In order to gather information from WCC and supply chain staff on qualitative implications and possible solutions, eight interviews were conducted. In the process, two scenarios[5] describing two possible futures by 2015 were used to set the scene.

2.4.4 In the **Analysis** performed we paid special attention to the link between the financial vulnerability assessed by the data analysis and the qualitative risk assessment driven by the workshops and interviews.

3 FINDINGS: ENERGY

3.1 UK ENERGY SECURITY AND PEAK OIL: HIGHLY RELEVANT TOPICS IN A GLOBALISED WORLD

3.1.1 **Energy security** refers to the loss of economic welfare that may occur as a result of a change in the price or availability of energy[6]. This loss of welfare can impact locally and nationally. Contrary to peak oil, the issues of energy security can be dealt with by governments and businesses influencing investment policies, planning, international relations, and lobbying. To understand what it is, the impact in the UK and what is being done, it is important to look into the **generation**, **regulation**, **storage** and **distribution of energy in the UK**.

3.1.2 **Electricity / Power Generation -** Since the industrial revolution the UK's economy has been highly dependent on fossil fuels. A good example of this is the electricity supply. Back in the 1940s 90% of the electricity was fired by coal. This share reduced significantly representing 32% today and expected to be 22% in 2020 (see Table 1). The reduction was supported by increasing the amount of gas being used (from just 0.05% in the 1990s) and nuclear power.

Electricity Mix 2009	%	Electricity Mix 2020	%
Gas	45	Gas	29
Coal	32	Coal	22
Nuclear	13	Nuclear	8
Renewables	6	Renewables	31
Other Sources	2	Other Sources	9
Oil	1	Oil	1

Table 1: Electricity mix 2009 and 2020 in the UK[7]

3.1.3 **Gas** is a particular case as its discovery in the North Sea enabled increased production and consumption in the UK. Production rose for a decade until peaking in 2000. Consumption increased consistently during this period overtaking production in 2006, and turning the UK into a net importer of Gas (Figure 2). By 2020, the UK could be 70% reliant on imports with an increasing share of liquefied natural gas (LNG) imported from countries like Qatar, Algeria, Trinidad and Egypt.

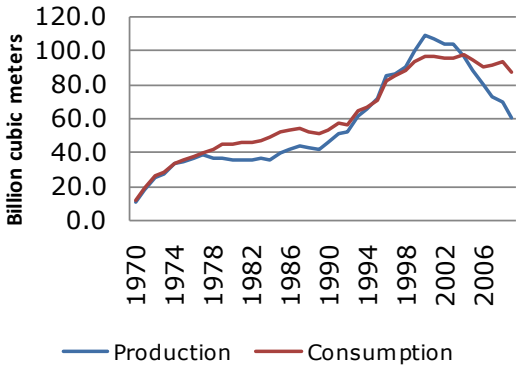


Figure 2: Gas production and usage in the UK[8]

3.1.4 **EU Regulation and Nuclear Power Plants** - The difference in the current electricity mix and the one predicted to 2020 is drastic. This is driven by three main factors. The decrease in gas can be explained by the production pattern in the North Sea. The decrease in coal fired generation is due to European Union regulation forcing the closure of heavily polluting plants. The reduction in nuclear is a result of nuclear power plants being at the end of their lifetime. As currently planned these reductions imply a c.30% drop in the electricity generation by 2018. These reductions are expected to be offset in the short to medium term by a bigger reliance on renewable energies.

3.1.5 **Investment and Planning** - Under the current scenario, long-term planning is needed. National Grid estimates a £4.7 billion[9] required to replace the transmission system, while new power plants and renewable energies will need £200 billion over the next 10 years[10].

Did you know?

- The UK has only c.16 days of **gas storage**. This compares with 73 in Germany and 91 in France.
- 9% of all electricity generated in UK plants is **lost across the grid** until reaching our homes

3.1.6 **Peak Oil** is based on a **few simple ideas**: Oil is a finite resource, you have to find it before you can produce it, and so production must start and end, passing a peak in between. Moreover, it is increasingly difficult and costly to find new areas. Peak Oil is about **when** and **how** the peak in world oil production will occur, and **what** the **consequences** of this are. It is not about suddenly running out of oil!

3.1.7 **Why peak?** Oil production from a field typically follows the pattern shown in Figure 3. At first, pressure in the reservoir means it is easy for companies to increase production. But eventually, pressure decreases, making it harder to keep production at high levels. A region (and the world) contains many of such fields. Typically, the biggest fields are discovered and exploited first. When combining the output of all the fields in a region, a bell-shaped curve emerges, with the peak occurring when about half of all recoverable resources have been depleted.

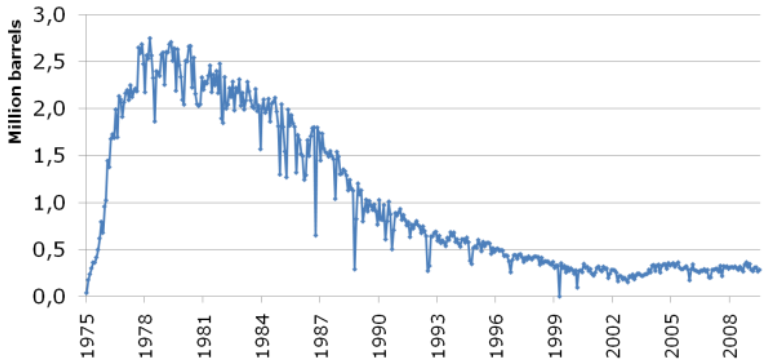


Figure 3: Monthly production pattern of the biggest oil field in the North Sea, Forties[11]

3.1.8 **How far are we?** Figure 4 shows world oil discovery against production in billion barrels per year (Gigabarrel/annum). Since 1981, the world has been producing more oil than it has discovered. Quite obviously, such a gap is not sustainable in the long-term.

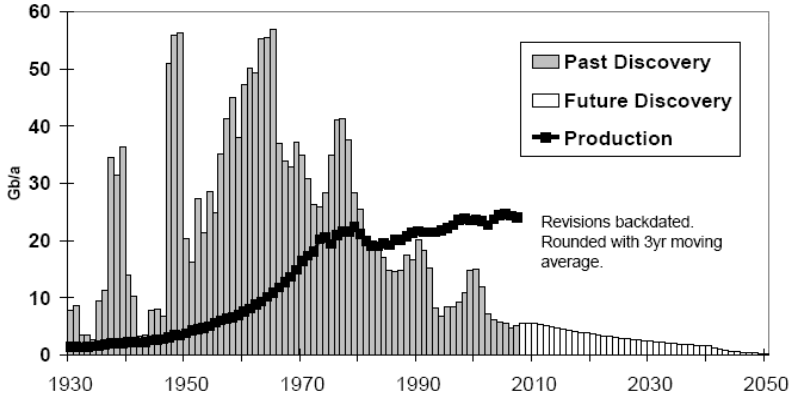


Figure 4: The growing gap between oil discovery and production[12]

3.1.9 **Peak when?** The question of when the peak will occur is highly debated and different sources give different answers to this question. The timeline in Figure 5 shows some of the forecasts and subsequent production rates (in 2030). Production today for all-oil[13] is about 85mb/d.

3.1.10 **Consumption** of oil, on the other hand, does not show any signs of slowing down. While in OECD countries, the price rises of recent years generally led to decreasing demand, this has not been the case for the developing world. China almost doubled its oil consumption over the last decade, while it increased by 50% in India and Middle East. Although strong economic growth is an important cause of this, it should also be noted that oil is heavily subsidised in these countries. Perhaps understandably, the average Saudi citizen does not accept to pay

more than £0.10 per litre of fuel. Saudi Ministers have also stated that they intend to keep more of their reserves for Saudi domestic consumption over the coming decade.

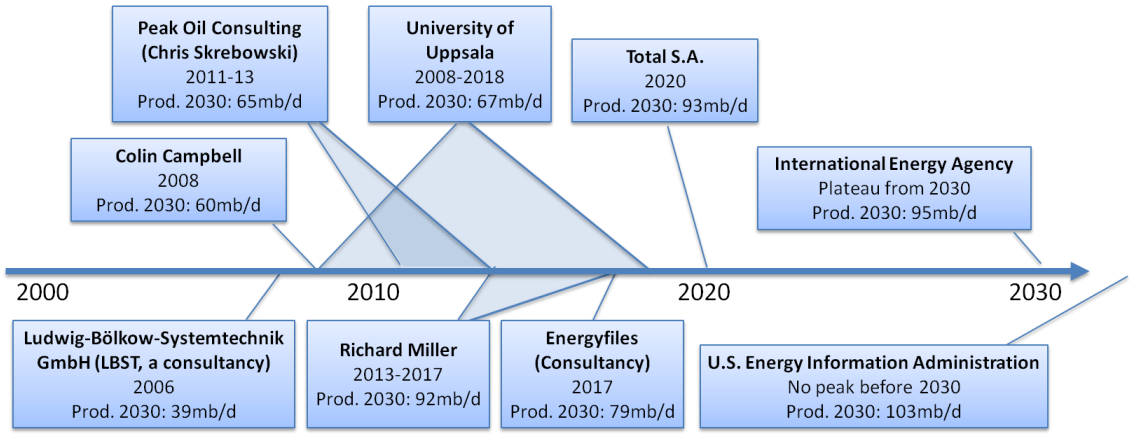


Figure 5: Range of peak dates from individuals, consultancies, and agencies[14]

3.1.11 **Decreasing supply + increasing demand = ?** The result of this equation can only mean that prices go up, and considerably so. Figure 6 shows a range of price forecasts, clearly indicating that there is hardly any argument over the general direction. However, uncertainty over the magnitude of future price levels is quite high, with forecasts ranging from $50 to $200 per barrel. With the exception of Paul Stevens' forecast and that of the Deutsche Bank, the prices refer to average yearly prices, not price spikes.

3.1.12 **High Prices - so what?** High oil prices have a remarkable track record of triggering global recessions as Figure 7 shows. The reason for this is that oil really is used everywhere in the economy, from electricity to heating to transport to petrochemicals. An especially concerning example is food production. The whole value chain from growing the food (tractors using fuel, herbicides and pesticides from petrochemicals) to processing (cleaning, cutting, cooking are all energy-intensive processes) to storage (cooling and cold stores) to transport.

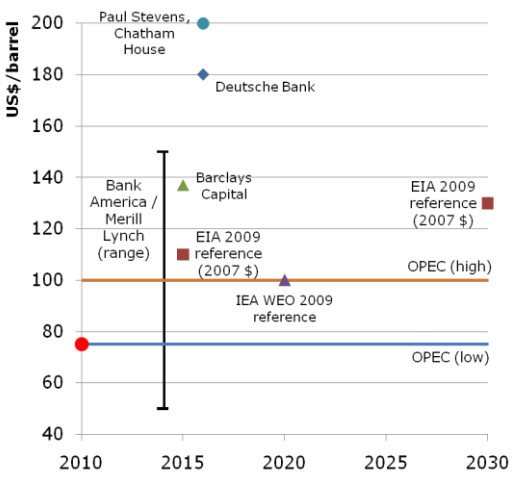


Figure 6: Different price scenarios for crude oil[15]

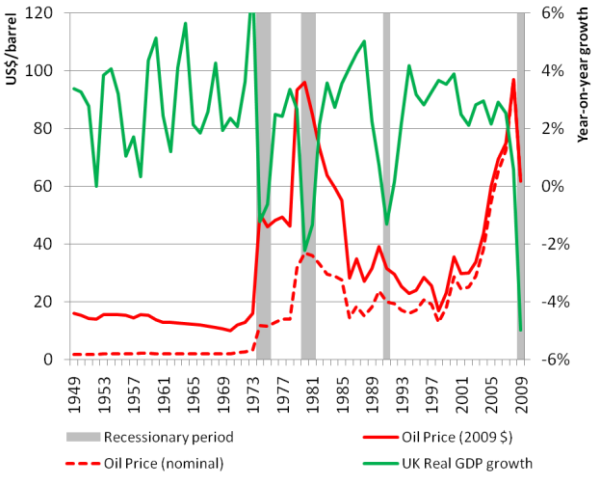


Figure 7: Link between oil prices and GDP growth[16]

3.1.13 More than shortages, both phenomena of UK Energy Security and Peak Oil will materialise in **higher costs**. Some analysts talk of an 'undulating plateau' of price volatility as prices rise and fall in line with increasing and falling demand. In economies that grew in the last few decades based on the assumption of cheap energy this will require adaptation of current operations and a strong behavioural change. The Warwickshire County Council, aware of these challenges,

commissioned this work. Next we will review the influence of UKES & PO on power, heating, transport, and products.

3.2 INFLUENCE ON POWER, HEATING, TRANSPORT, AND PRODUCTS

3.2.1 **Power**: **Prices** - The issues outlined in Section 3.1 will have a profound influence on the price of electricity. The last 5 years have already seen prices rise by almost 60% and regulator Ofgem believes that they could in some scenarios increase by as much as another 60% within the next 5 years[17]. The relationship between oil prices and electricity prices is not straightforward, as Figure 8 shows. Academic research confirms that the oil and electricity markets in the UK are not necessarily integrated[18], although this is debated and can change over time. Electricity prices are much more closely related to the price of natural gas, as also confirmed by the Eastern Shires Purchasing Organisation (ESPO)[19]. There should naturally be a relationship between oil, gas and electricity prices in the long-term since all three serve largely the same purposes and are substitutable.

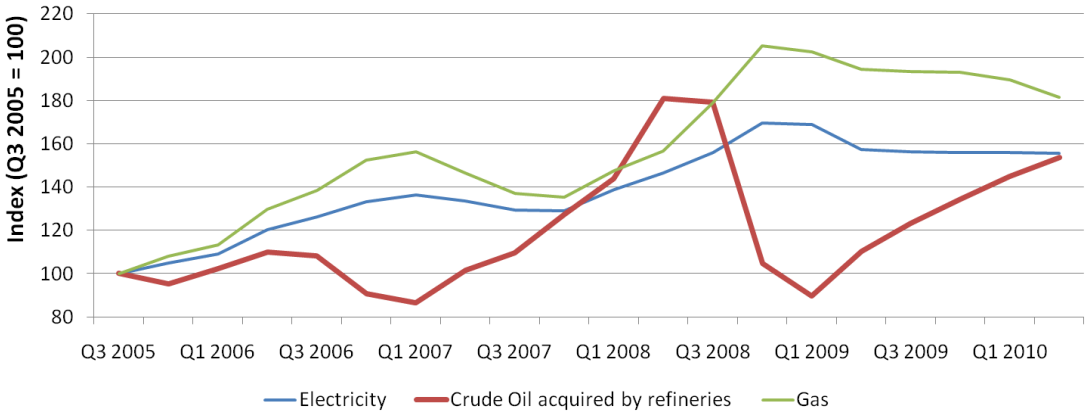


Figure 8: The relationship between crude oil prices with those of electricity and gas[20]

3.2.2 **Heating: Prices** - The vast majority of heating energy in the UK is generated by burning gas (81% in 2006)[21]. In mainland Europe gas prices are usually more stable than oil prices as pipeline gas is contracted for the long-run ('take-or-pay contracts'). In the UK, these contracts are typically of shorter duration due to the historic reliability of North Sea gas supplies. Since such contracts are made on the basis of the oil price, a long-term relationship between oil and gas prices exists. UK Energy Security issues as outlined above furthermore imply a greater reliance on LNG, which is fully susceptible to world markets and can be expected to move closely with oil prices. The price of heating oil is very closely related to the price of crude, almost on a one-to-one basis.

3.2.3 **Power: Outages** - From its scenario analysis and stress tests, Ofgem concludes that power outages will be unlikely during the next decade. The regulator believes that potential risks would - if at all - affect industrial and commercial users with interruptible supply contracts. This is based on the assumption that in those scenarios where lost nuclear and coal capacity is not replaced with renewable energy and new nuclear investments, high prices will spur investments in new gas-fired plants.

3.2.4 **Heating**: **Outages** - Gas supplies have a more immediate exposure to supply risks than electricity. Consequently, Ofgem believes that under some scenarios, in a 1-in-20 winter even firm industrial and commercial supplies might have to be cut off. The outage risk is driven by the short capacity storage in the UK. If peak demand is considered, the UK has only c.16 days of storage. This compares with 73 in Germany and 91 in France.

3.2.5 **Transport: Prices** - Figure 9 shows the relationship in the UK between the price of crude oil and that of petrol (unleaded super). Despite the evident lower volatility of petrol prices, the recent increase of over 30% in only 18 months to the new record of over 120p/litre shows that 'lower volatility' is relative and that prices generally follow crude oil prices.

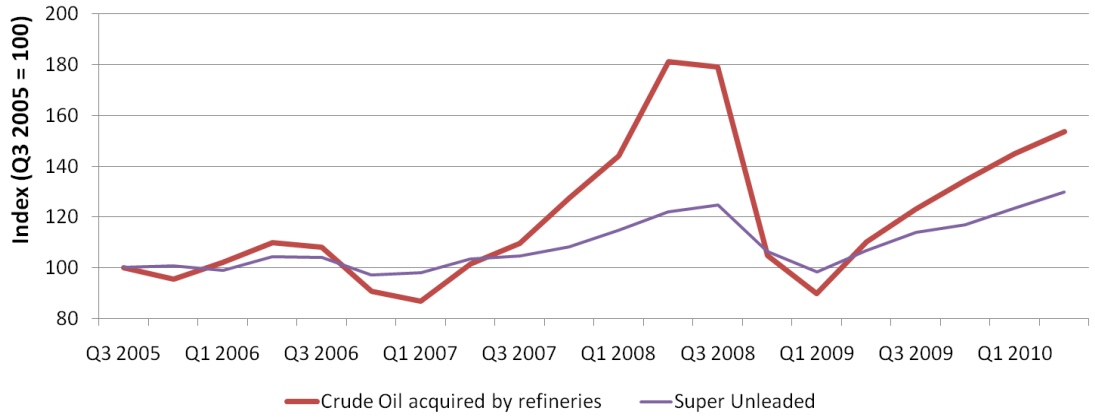


Figure 9: The relationship between the price of crude oil and super unleaded[22]

3.2.6 **Transport: Shortages** - The fuel protests in 2000 have illustrated the severe consequences that can result even from a relatively short period of interrupted petrol supplies. Less than a week into the protests (which took a few days to affect all major refineries), the NHS was put on red alert and Sainsbury's was warning that it would soon run out of stock. Such consequences are less likely from global supply disruptions (stocks would buffer the effect and consumption could be rationed), but clearly illustrate how utterly dependent we are on the supply of fossil fuels. It is understood that lessons have been learnt from experiences in 2000 and incorporated into national and local emergency planning activities.

> "There is a real danger now for the NHS and other essential services. Lives are at risk."
>
> **Tony Blair, Sept 14, 2000 (Day 7 of the Fuel Protests)**

3.2.7 **Products: Food** - Food prices and the agriculture sector in general can be one of the most vulnerable to energy prices. From energy used in farming and transportation to natural gas present in nitrogen fertilizers, fossil fuels dominate the entire supply chain. Simon Snowden, specialist in vulnerability to resource depletion from the University of Liverpool states that depending on the agriculture method, food prices can be 30% to 80% vulnerable to oil. The impact on food prices increased in recent years with the usage of some crops for the production of biofuels. This creates extra pressure on global supplies. The food sector is hit from two sides then: Through its own use of energy and through biofuels eating away an increasingly large share of its output.

3.2.8 Figure 10 presents the relationship between prices for crude oil and wheat, corn and soybeans. The relationship between crude and crops prices is evident from the graph, with crops prices following the oil price spike in 2008. It is, however, much less clear how rising costs get passed through to the consumers. One WCC supplier of frozen food stated that they perceived no obvious link between rising oil prices and slightly rising food prices during the oil price spike in 2008[23]. It will be of interest to keep a watching brief on this relationship - will companies be able to absorb costs and remain competitive, or will prices rise to reflect increased costs at each stage of food production from field to plate?

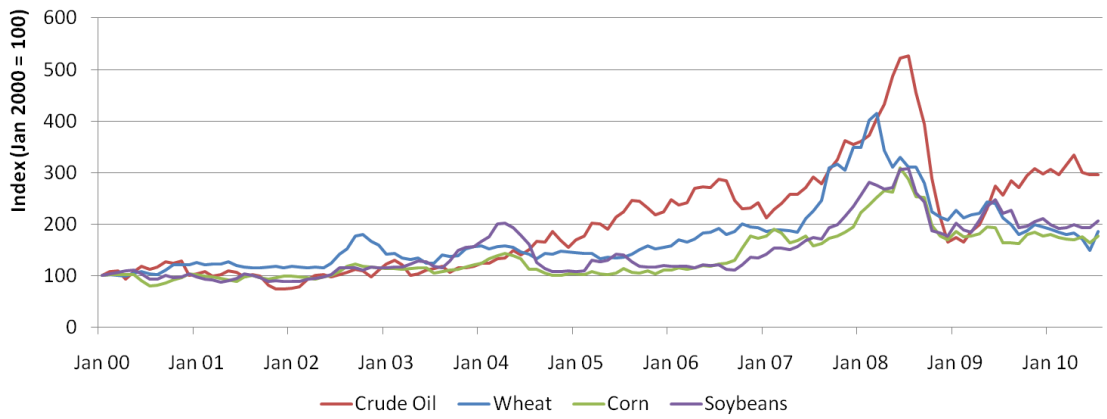


Figure 10: The relationship between the price of crude oil and different crops[24]

3.2.9 **Products: Bitumen** - A sticky, tar-like form of petroleum, bitumen is used for waterproofing in buildings and mainly in highways construction and maintenance. There is no world price for bitumen, but data from the Department for Business, Innovation and Skills (BIS) shows a 10% yearly increase in prices for asphalt in the last 5 years.

3.2.10 **Products: Electronics** - Several studies suggest that manufacturing of electronic devices is a process that requires a lot of energy as well as materials made directly from fossil fuels. A 2004 study estimated that the total energy and fossil fuel required to build a computer and CRT monitor in the year 2000 was equivalent to 6400MJ, corresponding to a little more than a barrel of oil[25]. Despite this, prices of computers have decreased significantly. We will therefore assume no significant price increases in this product category.

3.2.11 **Price Scenarios in 2015** - The price scenarios in Table 2 are by no means a prediction, nor do we attach a likelihood to them. The increases are justified both by the price analyses above and by the fact that they are meant to stimulate discussion. We firmly believe they are a possibility of what the future might hold and by merely looking at the past 5 years, one can see that such price increases are not outlandish. Furthermore, the question "**What if** we were to encounter such price increases?" is one that is worth answering as Chapter 4 will show. It is the first step in preparing for the risk of such or similar price increases.

3.2.12 We chose the **timeframe** of 5 years for several reasons. Firstly, the detailed analysis of megaprojects in the oil industry presented by the Industry Task Force on Peak Oil and Energy Security (ITPOES) shows that a supply crunch in oil is likely to occur within the next 5 years already. Secondly, the scenario analysis and stress testing performed by Ofgem also reveals the middle of the decade as the most critical period. By choosing a relatively short time frame, we want to make clear that UK Energy Security and Peak Oil are immediate, not distant issues.

3.2.13 The price scenarios are **used** later to determine the possible financial impact of UK Energy Security and Peak Oil on selected services. Costs of each service area have been broken down into the components shown in Table 2 as far as possible. Then, the increases are applied to each component and added up, yielding the total impact on the service.

	Base Scenario	Stress Scenario
Crude oil	+90% $150 / barrel	+200% $250 / barrel
Electricity	+40%	+60%
Gas	+55%	+115%
Heating Oil	+80%	+180%
Unleaded Petrol	+40% 175p/l	+100% 250p/l
Food	+20%	+40%
Bitumen, Asphalt, Surface Dressing Binder	+40%	+60%
Computer	+-0%	+-0%
All other (Inflation)	+10% (2.0% p.a.)	+15% (2.8% p.a.)

Table 2: Price assumptions for scenarios

4 FINDINGS: IMPACT ON WCC SERVICE DELIVERY

4.1.1 In this section, we will present our findings about the impact of UK Energy Security and Peak Oil on selected service areas. For each area, we will show the key financial and qualitative impacts, as well as an indicative list of how to deal with these impacts.

4.1.2 The financial assessments are based on the assumed price increases presented in Table 2. Please note that all changes from 2009-2010 to 2014-2015 include the effect of inflation.

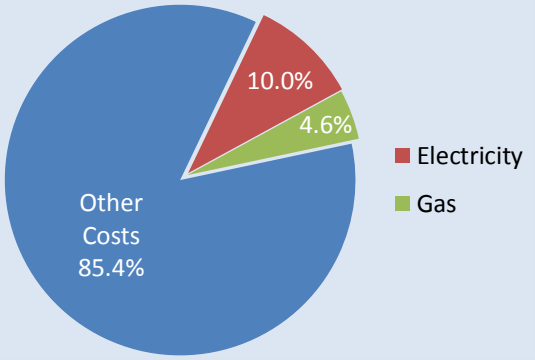
4.1.3 The assessment also includes a discussion and evaluation of the situation of each area as well as recommendations on how to proceed.

4.1.4 Chapter 5 focuses more on procedural recommendations - in particular a process for future data collection, risk assessment and consideration of mitigation strategies. Table 4 brings together recommendations from Chapters 4, 5 [and from within earlier chapters] for easy reference and to explore synergies.

4.2 COUNTY BUILDINGS AND AREA OFFICES

Current Financial Position - 2010/2011

Total Budget £5,662,870



Financial Impact of Scenarios from 09-10 to 14-15

Base Scenario	Stress Scenario
+ 15% or + £830,000	+ 24% or + £1,330,000

Qualitative Impacts[26]

- Increasing property costs lead to budget pressures and potential cuts
- More reliance on home working might lead to decreased property requirements

Indicative Mitigation Options[27]

- More efficient lighting
- Less usage of A/C
- Biomass boiler heating
- Better insulation
- Better usage of public buildings, including schools
- Use of smart meters

4.2.1 **Information** - County Buildings and Area Offices includes 24 buildings, mainly offices. There are some 400 additional buildings under Council administration. While the vast majority of those are schools, the figure also includes fire stations, libraries, community centres and others. Financial information about these two areas was retrieved from the General Ledger and can thus be deemed reliable.

4.2.2 **Evaluation: Financial Impact -** The analysis shows that in the area of building administration approximately 15% of costs are directly vulnerable to rising energy prices. Other costs in this area revolve mostly around rates, rents as well as cleaning and caretaking (£3m total), so this position only refers to the cost of running the building! The figures show that there is a potential of £1.3m in additional yearly costs for WCC's 24 office buildings. Considering that the County has some 400 more buildings in its portfolio, this is quite a substantial impact.

4.2.3 **Evaluation: Qualitative Impact** - Changes in service demand and working customs (more reliance on home working) may change property requirements.

4.2.4 **Recommendations** - From our conversations with Bill Johnson it appears that a lot is already done to improve building efficiency, which is certainly at the heart of mitigating the impact. The list of possible options are:

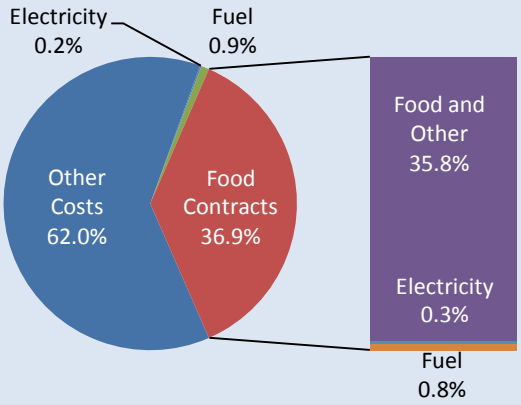
- Continue and expand the ongoing efforts to **develop efficiency & on-site generation** as economically sensible
- Consider **future** instead of current **prices** in the appraisal of improvement schemes. This would reduce payback periods and enable a more aggressive investment approach.
- Invest in **awareness** raising campaigns to reduce energy use.
- **Incentivise** energy savings. This could be done by:
  - Publishing energy usage of different offices areas (league table of offices).
  - Giving financial incentives.

4.2.5 **Limitations** - Analysis does not include other county buildings.

4.3 CATERING

Current Financial Position - 2010/2011

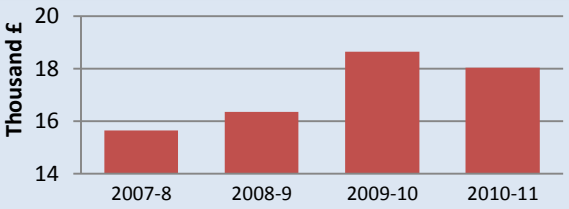
Total Budget: £9,438,207



Financial Impact of Scenarios from 09-10 to 14-15

Base Scenario	Stress Scenario
+ 14%	+ 25%
or	or
+ £1,350,000	+ £2,430,000

Development of Food Spending Per School Day



Qualitative Impacts[28]

- Higher food prices could lead to a reduced number of customers which in turn endangers the economies of scale of suppliers leading back into even higher prices
- Impact on clients service requirements (unspecified)
- Nutrition regulation makes it near impossible to source all food locally
- Gas and electricity shortages would impact on the cooking capacity
- Fuel shortages hardly a problem as food suppliers are treated as priority in case of shortages (as experienced in 2000)[29]

Indicative Mitigation Options[30]

- Source more food locally
- Consider linking food contracts so that only one company is used for all food deliveries

4.3.1 **Information** - County Catering provides catering services mainly to schools, but also to customers within the authority. It works together with two main suppliers, one for frozen food and one for dry food, who deliver directly to the schools, where county catering staff prepares the meals. Electricity and gas used for cooking is paid for directly by the schools.

4.3.2 **Evaluation: Financial Impacts** - The financial impacts of direct electricity, gas and oil prices do not seem drastic for County Catering. Only a very small amount of the budget is spent on electricity and fuel. Also the food suppliers, even in the case of frozen food, only spend less than 3% on energy. While oil prices and prices for staple food are related, the effect on processed end-products is less clear as discussed in Sections 3.2.7 and 3.2.8. Under the assumption of food price rises as outlined in the scenarios, the department would be highly impacted as the box shows.

4.3.3 **Evaluation: Qualitative Impacts** - Higher food prices would have an effect on the system client-WCC-supplier that might result in ever higher prices. Also, the impact on the client's service requirements is not fully comprehended yet. We do not expect shortages to become a significant risk for its operations.

4.3.4 **Recommendations** - County Catering, more than managing the impact on its operations, could make a contribution to an energy conscious education in schools. This would include sourcing as much food as possible locally and educating pupils about the energy waste that is associated with some overseas products. In any case should the price relationship between energy and food be monitored to be alert for any delivery or policy implications.

4.3.5 **Limitations** - Impact of rising oil prices on the price of food (for the consumer) not fully clear.

4.4 ICT

4.4.1 **Information** - ICT is part of the Resources Directorate and responsible for providing ICT facilities to the service directorates. From providing equipment to maintaining networks to internal advice on how to best exploit ICT facilities, the area's aim is to assist Directorates in providing high quality and efficient services.

4.4.2 **Financial Impacts** - From the analysis performed there is no clear evidence that the ICT area is negatively affected by rising energy prices.

4.4.3 **Qualitative Impacts**[31]:

- Demand for ICT support for home working increases
- Demand for on-site ICT services increases as customers shift to online services
- Bigger ICT facilities, bigger cooling facilities, more energy consumption
- Electric capacity may be reached in some buildings
- Digital divide may be more of an issue if mobility decreases
- Higher dependence on ICT and more outages may require better local backup facilities

4.4.4 **Indicative Mitigation Options**[32]:

- Invest to save, i.e. improve efficiency of ICT facilities
- Rethink budget accountability, incentivise energy savings for ICT users
- Promote behavioural change in the use of equipment

4.4.5 **Evaluation: Financial Impacts** - We do not anticipate any major direct financial impacts through the cost of materials for the reasons outlined in 3.2.8 (Products: Electronics). The electricity use of the ICT equipment is paid for by the users, so there is no direct impact on the ICT budget.

4.4.6 **Evaluation: Qualitative Impacts** - We expect a significant increase in the demand for ICT services under our scenarios. This will affect in-house services as well as web-services and systems for communicating with WCC's customers. Furthermore, decreased mobility leading to greater reliance on online service delivery will exacerbate the problem of digital divide. A higher dependence on ICT might also lead to a need for better local backup of power supplies. In a second stage, an increased size of ICT facilities would in turn lead to increased energy consumption, especially since bigger ICT facilities require more cooling and thus energy consumption increases disproportionately.

4.4.7 **Recommendations** - Possible options are:

- Continue and expand the ongoing efforts to **use more efficient devices** as economically sensible
- Consider changing the budget responsibilities so that the ICT department pays the bills for the electricity it uses, to then bill their clients. This would enable the team to use some of the allocated revenue spending to invest in its own facilities.[33]
- Continue and expand **behavioural change** campaigns that aim to reduce unnecessary use of equipment

4.4.8 **Limitations** - Analysis carried out purely in qualitative terms, as financial impacts were considered minor at an earlier stage.

4.5 DESIGN AND CONSTRUCTION

4.5.1 **Information** - The Design and Construction group is responsible for project management of large building projects. Work conducted includes planning and the design of building specifications to tendering and monitoring construction progress. The Design and Construction group has an interesting role to play in the context of this study as it determines the energy specifications of any new or refurbished building.

4.5.2 **Financial Impacts** - From the analysis performed there is no clear evidence about the direct financial effects on the Design and Construction areas. The financial manager responsible for the property area searched for significant energy spending within the budget, but could not find any. However, the head of the area believes that some of the materials used in construction are susceptible to rising energy prices (e.g. cement and plastics).

4.5.3 **Qualitative Impacts[34]:**

- Budget decreases further due to price pressures in other areas
- Generally more challenging budgeting decisions
- Decrease in construction budget affects service area revenues (fee driven)
- Building material cost increases, especially due to higher transport costs
- Building regulation
- Compliance with Carbon Reduction Scheme
- Demand changes: More energy efficient buildings required
- Staff: 20% of people living further away than 20miles

4.5.4 **Indicative Mitigation Options[35]:**

- Alternative, less energy intensive materials
- Build the skills required for new tasks and thinking
- Work together with supply chain, consider market making for new technologies and materials
- Consider changing the funding model (currently fee driven)
- Combine procurement of several sub-regional authorities to achieve greater buying power

4.5.5 **Evaluation: Financial Impacts** - We do not anticipate any major early financial impact on this service area. Nevertheless, it would be advisable to consult more industry experts on the price effect on materials. Our interviews with supply chain companies did not produce major insights in this respect. This is because the construction companies we interviewed do not perceive rising energy prices as a major threat because if they are right then price rises will be passed on to WCC.

4.5.6 **Evaluation: Qualitative Impacts** - The two main qualitative impacts mentioned to us in this area were budget pressures through increased spending in other areas and demand changes. Budget cuts for this fee-driven area mean a potential scaling down of the department. Demand changes towards more energy efficient buildings on the other hand may require different skills. In addition, the service area will have to deal with changing building regulations. As mentioned earlier, material costs may increase driven by rising energy costs. About 20% of the people working in this area live further away than 20 miles, which could impact on turnover rates in high oil price scenarios.

4.5.7 **Recommendations** - Many mitigation options were suggested, though some have a very long term focus (e.g. skills) and others can relatively easily be implemented in the short term (the use of alternative materials should be an economic decision from project to project rather than a strategy). Possible options from our point of view are:

- Work together with the **supply chain** to determine likely impacts of high energy prices and develop solutions together

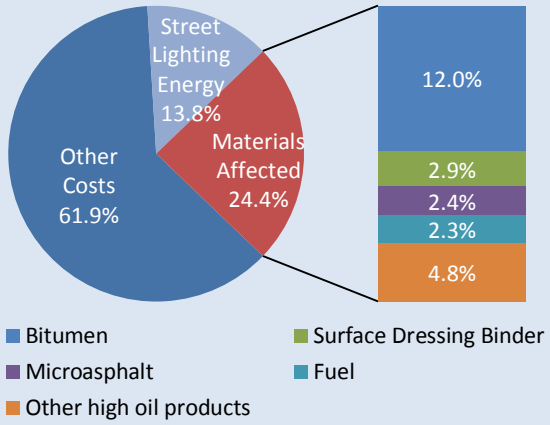
- Consider combining procurement of several sub-regional authorities to achieve greater buying power

4.5.8 **Limitations** - Analysis carried out purely in qualitative terms.

4.6 COUNTY HIGHWAYS

Current Financial Position - 2010/2011

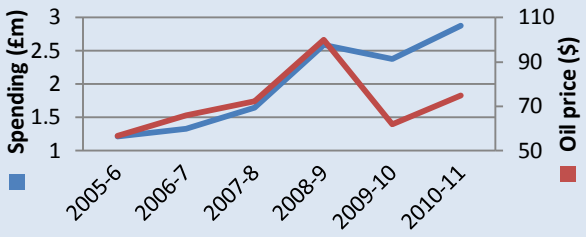
Total Budget: £20,879,366



Financial Impact of Scenarios from 09-10 to 14-15

Base Scenario	Stress Scenario
+ 21%	+ 33%
or	or
+ £4,230,000	+ £6,530,000

Street Lighting Costs Against Oil Prices



Qualitative Impacts[36]

- Potentially higher crime rates and fear of crime if street lighting is reduced
- Potentially increased accident rates if street lighting is reduced
- Reduced service
- Degradation of assets (e.g. road pavement)

Indicative Mitigation Options[37]

- Recycle SD stone and waste material
- Use local materials
- Use more efficient vehicles
- Use of LED lights
- Removal of light to road signs
- Reduce hours of street lighting
- Consider Area programmes of work instead of County Programmes

4.6.1 **Information** - County Highways is concerned with maintaining roads and highways in the County (including winter maintenance), managing traffic, organising new transport projects and managing street lighting columns throughout the County. Formally, there are three different service areas sharing these jobs. The analysis above is based on our cooperation with the Contract & Policy Management team as well as the Principal Street Lighting Engineer. Highways maintenance is currently contracted to Carillion plc.

4.6.2 **Evaluation: Financial Impact** - County Highways is an area with a very high vulnerability to rising energy and oil prices with 38.2% of all costs being directly related. Street lighting accounts for 13.8% while highways construction and maintenance (represented by the materials used) reflects the other 24.4%. The first activity faced a 238% increase in costs in the last 5 years mostly driven by the increase in electricity prices. Highways construction and maintenance makes use of energy intensive products and many sub-products of oil (e.g. bitumen and microasphalt). This leads to a very high financial exposure to peak oil.

4.6.3 **Evaluation: Qualitative Impact** - County Highways is responsible for managing c.£2.5 billion in a wide range of assets spanning from highways to roads to street lighting posts in Warwickshire. A general increase in energy prices may lead to a reduction in service and therefore a degradation of these assets with implications on availability and quality of transport routes. Street lighting in particular is strongly affected by qualitative aspects, as reducing it might lead to higher rates of crimes and road accidents. We expect no immediate demand changes and the impact on staff seems insignificant. The biggest concern arises from the financial impacts, which might lead to drastically reduced service levels.

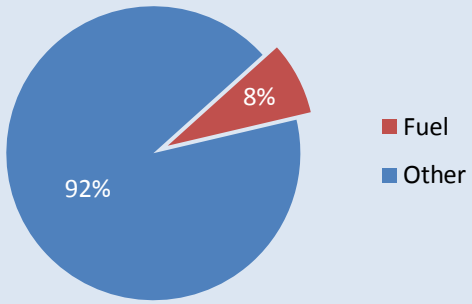
4.6.4 Recommendations - There are various possible options for mitigation available that should become viable at higher energy and oil prices. We are under the impression that especially in the area of Street Lighting a lot is already being done to mitigate impacts. Possible options are:

- Continue and expand the ongoing efforts to **recycle material and improve lighting**.
- In Street Lighting and Vehicle Purchases, consider **future** instead of current **prices** in the appraisal of improvement schemes to reduce payback periods.
- Consider the use of **alternative materials**, such as vegetable binders. Although these might not yet be of sufficient quality, it can be worth gaining experience now.
- Consider the effect of steeply rising prices when negotiation contracts

4.6.5 **Limitations** - All figures are indicative, with the exception of street lighting energy.

4.7 TRANSPORT OPERATIONS

Bus Fuel Spending compared to Contract Value (2009)[38]



Bus Contracts (2010/2011)	Fuel Card Spending (2009)
£19,700,000 (c. £1,576,000 in fuel)	£731,425

Qualitative Impacts

- Increasing demand for public transport
- Non-viability of some routes
- Risk of bus business failure
- Disruption due to fuel shortages

Indicative Mitigation Options

- Invest in more energy efficient vehicles
- Consider the use of biofuels
- Support contractors in the acquisition of new technologies
- Promote car sharing more effectively
- Training employees in more efficient driving techniques

4.7.1 **Information** - Transport operations refers to both Community Transportation and County Fleet. Community Transportation is responsible to provide access for those living outside (or unable to use) the conventional public transport network. These include school links and specialist transport. The service runs with contractors and individual volunteers driving their own cars. The county fleet area is responsible for the purchase and maintenance of WCC vehicles. The range spans from personal cars to buses and trucks used for gritting or fire fighting.

4.7.2 **Evaluation: Financial Impact** - Although no definite financial picture of this service area could be drawn, it is quite clear from the fuel-to-contract-value ratio of 8%, that energy and fuel price rises will have a strong financial impact. Through bus contracts and fuel cards, over £2.3m are spent on fuel. Our scenarios imply an increase of £0.9m to £2.3m in this item alone.

4.7.3 **Evaluation: Qualitative Impact** - The rise of energy prices and petrol prices in particular is expected to generate an increasing demand for public transport. Nonetheless, some of the routes particularly in rural areas may become economically unviable with consequences in their accessibility. With effects on community and county areas, fuel shortages resulting from supply shortages or fuel protests like the ones in 2000 can disrupt the transportation system with consequences to all other directorates using their services. On the supply chain side, higher petrol prices may affect the operation causing disruptions on the service. A sudden increase in prices like to one occurred in 2008 is difficult to accommodate by smaller contractors that, with no time to renegotiate the terms of the contract, incur in great losses[39].

4.7.4 **Recommendations** - Possible options are:

- Invest in more efficient technologies when purchasing new vehicles for WCC
- Work together with small and medium contractors to improve their efficiency. This can be done by setting longer contracts subject to the acquisition of more efficient vehicles[40].
- Reinforce the promotion of car sharing as a measure to reduce fuel consumption. This can be done by setting up a car sharing internal website where users post their journeys to match similar ones.

4.7.5 **Limitations** - Top-level expenditure not available.

4.8 FIRE & RESCUE

4.8.1 **Information** - The Fire & Rescue directorate provides a wide range of rescue services to the Warwickshire community beyond the traditional fire brigade responsibilities. The area is trained to provide assistance in wide range flooding and transport incidents. Focusing on making homes safer the area aims to increase the number of home fire safety checks and fitting smoke alarms. On the awareness side, Fire & Rescue is also committed to reduce accidental fire deaths and fire risk to local businesses.

4.8.2 **Financial Impacts** - From the analysis performed there is no clear evidence that the Fire & Rescue directorate is financially affected by rising energy prices. During the last 3 years (information available) energy related costs never accounted for more than 1.5% of the total cost and even in a stress 2015 scenario, the rise of energy prices above inflation would take this value to 2.4%.

4.8.3 **Qualitative Impacts**[41]:

- Reduced prevention and intervention
- Potential loss of lives

4.8.4 **Indicative Mitigation Options**:

- Investment in more efficient vehicles[42]
- Establish a method for measuring energy consumption (already in place)[43]
- Comply with the requirements of National Indicator 188 – Adapting to Climate Change (already in place)[44]

4.8.5 **Evaluation: Financial Impacts** - Fire & Rescue structure has low vulnerability to energy prices. In the current scenario, electricity, gas, petrol and oil represent 1.45% of the £23m total expenditure. The service is vital to the community so even under a stress scenario there should be no risk of disruption due to financial constraints.

4.8.6 **Evaluation: Qualitative Impacts** - The Fire & Rescue Service provides an essential service that will surely need to be provided despite the increase in energy prices. However, the rise of petrol prices in particular may reduce the range of services in place at the moment narrowing down the action to fire fighting, and intervention in major floods and transport incidents. The current focus on prevention and risk reduction may be forced diminished due to other, more important priorities. If, in an extreme scenario, the service faces actual disruptions leading into potential loss of lives, these would have a much higher impact in terms of the responsibility of the county council towards their citizens.

4.8.7 **Recommendations** - The list of possible options are:

- Invest in **more efficient** vehicles as fleet needs replacement.
- Continue the actions in place to measure energy consumption and adapt to climate change

4.8.8 **Limitations** - Analysis carried out purely in qualitative terms, as financial impacts were considered minor at an earlier stage.

4.9 CHILDREN, YOUNG PEOPLE AND FAMILIES

4.9.1 **Information** - The CYPF Directorate is the second largest in terms of budget and is mainly concerned with providing educational services. Financially, it does not include schools, however, which are administered autonomously.

4.9.2 **Financial Impact** - Direct electricity, gas and heating oil costs represent less than 0.5% of the Directorate's total budget. Indirect financial impacts were not quantified, but considering for example bus contracts representing almost 17% of the budget in 2010/11, there is good reason to believe that this Directorate would feel the impact of steeply rising energy prices in its financials.

4.9.3 **Qualitative Impacts** - No data was collected on the qualitative impacts on the CYPF Directorate. However, many other service areas analysed are in some part embedded in or used by CYPF or associated entities. This includes:

- Transport (mainly school buses)
- Catering (mainly school meals)
- Buildings (mainly schools, but also Youth Centres etc)

In terms of demand changes, there could well be a shift towards increased usage of public services by those children that come from lower income groups and for example cannot afford a car at significantly higher fuel price levels. If higher energy prices / spikes were to lead to further economic recessions then that implies reduced employment, lower household incomes and increased demand for free school meals and other services. The impact of shortages is not considered vital as, although undesirable, a lost school day should not present schools with insurmountable problems.

4.9.4 **Recommendations** - There is a potentially large impact on the finances of this Directorate and associated entities like schools. We therefore suggest looking at these issues in more detail. In any case, the sheer size of the Directorate will mean that even small relative financial impacts will be large in absolute terms for the authority, thereby justifying a deeper analysis.

4.9.5 **Limitations** - The diversity of service offerings and those who deliver it makes it hard to analyse implications in detail, all of the above is therefore based on extrapolation from other areas.

4.10 ADULT, HEALTH AND COMMUNITY SERVICES

4.10.1 **Information** - Adult Social Care provides a wide range of services for adults living in Warwickshire, people in need and people who care for others. Services range from professional support to transport to delivering meals. They are provided either directly by WCC staff, volunteers or private organisations.

4.10.2 **Financial Impact** - The share of costs directly affected by rising energy prices (i.e. electricity, gas, heating oil, transport fuel) in this service is less than 0.5%. Indirect financial impacts (e.g. through service and supply contracts) could not be quantified.

4.10.3 **Qualitative Impacts** - No data was collected on the qualitative impacts on the AHCS Directorate. However, many of other service areas analysed are in some part embedded in or used by AHCS. This includes:

- Transport (e.g. for people who attend day care centres)
- Catering (e.g. meals delivery to homes)
- Buildings (e.g. day care homes, community centres)

Furthermore, there might be demand changes, for example because fewer clients of AHCS are able to afford a car.

4.10.4 **Recommendations** - We conclude that there is a potentially significant impact on AHCS, making it worth analysing these issues in more detail. Just as with CYPF, the sheer size of the Directorate will mean that even small relative financial impacts will be large in absolute terms for the authority.

4.10.5 **Limitations** - The diversity of service offerings and those who deliver it makes it hard to analyse implications in detail, all of the above is therefore based on extrapolation from other areas.

4.11 IMPACT OF PRICE INCREASES ON STAFF'S OWN TRAVEL COSTS

4.11.1 Early work undertaken by Simon Snowden (Liverpool University Management School, Oil Depletion Impact Group) on the vulnerability of business operations to rising prices for oil and oil based products has revealed anecdotal evidence that the impacts on staff travel costs in particular - but also indirect impact on disposable household income - could be very significant. This might for example be important for lower income members of staff living further away from work - and for the Council if staff find they can no longer afford to travel to their place of work.

4.11.2 This evidence was not significantly reflected in discussions held in this project – but it is nevertheless recommended that a watching brief be kept and that the opportunity be taken in a future 'travel to work' survey to ask questions around sensitivity of travel costs in relation to their current place of work.

4.12 IMPACT ON SUPPLY CHAIN COMPANIES

4.12.1 The evaluation of the impacts on WCC service delivery embodies the analysis of the supply chain companies' sectors. When looking into industry sectors rather than individual companies/organizations the financial implications lose power to other areas, including competitiveness of the market, pricing strategies and type of contracts.

4.12.2 Contrary to WCC, the companies in the supply chain may respond to the increase in energy prices, their raw materials and other operational costs by increasing the price charged for their services. From WCC's point of view, since there is a social responsibility to provide the services

to the citizens, the increase in costs cannot always be passed on and is therefore often reflected in a lower capacity to deliver.

4.12.3 Even knowing that the analysis of the companies in the supply chain is supported by less hard data than the areas presented above in this section, a qualitative assessment of the dynamics in each industry permits an understanding of commonalities and differences. The different interviews performed with industries practitioners (as presented in Appendix E:) revealed common ground regarding the concern about regulation changes, the need of investing to save, and changes in demand. However, each industry is affected in different extents by each of these areas.

4.12.4 **Construction companies** have seen their costs shoot up driven by the rising material prices. The building costs index published annually by Building Magazine in the UK reveals that since 2002 the aggregate increase in different materials reached up to 60%.[45] In line with the findings presented in 3.2.9, bitumen appears on top of the list as the most affected material with cement coming next driven by strong international demand and limited supply in the UK.

4.12.5 Despite this, prices are not such a concern to companies operating in this sector. As highlighted in the interview with George Martin, Head of Sustainable Development at Willmott Dixon Construction, the increase in prices is passed on to the consumer and ultimately gives an extra incentive for clients to invest in energy efficient solutions. Particularly for clients in the public sector, the introduction of the buildings efficiency regulation to cope with cuts in carbon emissions will increase the number of projects that involve efficient construction. Companies providing these services will have an edge over their competition.

4.12.6 In the **highways construction and maintenance** sector, companies face a similar situation regarding the financial impacts. Cost of materials, with bitumen on top, are rising steadily creating an upward trend in the pricing charged to clients. However the type of contract introduces a different dynamic to the equation. Contrary to building contracts where a price is agreed upfront, highways construction and maintenance contracts have adjustment factors subject to the price of commodities (e.g. crude oil price). It should be noted though that due to the size of these operations, there are few providers in the sector capable of delivering the service giving each one a strong supplier power. In this case, the value to WCC needs to come from strong negotiation in order to mitigate the impact of prices volatility.

4.12.7 The **transport operations** sector shows the highest vulnerability to increasing energy prices with possible service disruptions if companies go out of the market. Financially, they are exposed to a high percentage of the costs directly tied up with oil prices. Section 4.7 presented an example of a small provider in Warwickshire with fuel representing 8% of total operating costs.

4.12.8 The competitive landscape presents the biggest challenge with the high number of players reducing the room to manoeuvre - impacting on the ability to increase fare prices, squeezing profit margins and consequently making the required 'investments to save' more difficult. The existing support from Government in the form of subsidies and grants (e.g. Green Bus Fund[46]) to replace the existing vehicles ends up benefiting largest operators with scale to invest. From WCC's point of view these transformations in the sector may impact on the way to deal with current providers. Possible cooperation and mitigation options are presented in section 4.7.

5 PROCEDURAL RECOMMENDATIONS

5.1 FURTHER RESEARCH TO BE DONE

5.1.1 Despite the magnitude of the impacts in each area, the analysis across service areas and directorates shows a common factor in their operations: an **extensive use of energy** directly and indirectly from the purchase of fuels and materials to the service delivery.

5.1.2 This finding paired with the real threats of UK Energy Security and Peak Oil and the likely increase in future energy prices requires further consideration and early planning to adjust current operations and mitigate the impacts. However, as stated in the limitations section (1.2), the accuracy of the financial information does not allow direct decision making and implementation based on the calculations presented in this initial work.

5.1.3 Further research is therefore recommended in each of the service areas and we propose the following steps to be undertaken:

a. What is the percentage of (1) electricity (2) gas (3) heating oil (4) transport fuel spending in different services/activity areas?
b. What would those costs be in a $150 - $250 / barrel scenarios - be they prices spikes or average prices?
c. Look for qualitative risks, such as changing regulatory requirements, variations in demand for services, and direct/indirect effects on staff.
d. Work with your supply chain to determine the impact on the price and security of your supplied and to find solutions.
e. Assess the **risks**! What *variations* in total costs are you facing (oil price might spike again to then fall back to a lower level)?
f. Consider different mitigation strategies such as increasing investment in efficiency measures and renewable energies.

5.1.4 Some of these tasks are very straightforward - after all we have not used many sophisticated techniques in this project. The most challenging part will be data collection, after which the quantitative analysis is fairly simple. Regarding the analysis of qualitative impacts, mapping techniques could help in understanding complex situations, but are not strictly necessary.

5.2 ACTIONS TO TAKE

5.2.1 Table 3 below shows an indicative list of general objectives to tackle that all work towards reducing the exposure to UK Energy Security and Peak Oil risks. An example key performance indicator shows how success in working towards the objective could be measured. Furthermore, we offer several concrete actions of how to tackle each objective, plus the potential challenges and opportunities that come with each of these actions. The table describes actions to take that are independent of the service area.

5.2.2 The list can of course only be an indicative list of ideas and the final actions taken are likely to differ substantially from those below. Nevertheless, the objectives are comprehensive and tackling these would reduce exposure to the risks outlined in this report substantially.

5.2.3 Chapter 4 clearly shows that many service areas are severely affected. The total impact on WCC could easily reach seven figure amounts. Therefore, cooperation across directorates and service areas is necessary to reduce exposure to these risks.

5.2.4 Table 4 brings together suggestions and recommendations from the early parts of the report alongside those in Chapters 4 and 5 as a quick reference and to assist in exploring potential synergies. Both Table 3 and 4 are organised around a range of suggested objectives.

Suggested Objectives	Example Key Performance Indicator (KPI)	How to tackle it	Potential Challenges	Potential Opportunities
Behavioural Change	Energy use per employee	Nominate champion in each area that takes these issues forward	Need to find someone with enthusiasm for the topic, someone whose word 'counts' and free up some time for this person → difficult	Also unforeseen implications could be covered as the champion would become an expert and be able to raise concerns wherever appropriate
		Incentivise savings by changing budget accountabilities	Budget system complex and changes politically difficult	Could unleash other benefits such as a simplified budget system
Increased Energy Efficiency	Energy use per sq. ft. of building area	Nominate champions	See above	See above
		Incentivise savings	See above	See above
		Work closely with Energy Manager and invest	The funding currently available to the Energy Manager might not be sufficient	Introduces rigor and scrutiny to each investment rather than jumping ahead
		Use Life-Cycle Costing	Data requirements higher than with other approaches	Can be used also to consider other operating costs such as maintenance
		Joined up working, better use of resources	Done anyways, further improvements might be difficult	Cost savings also in other areas than energy
Increased Investments in Renewable Energies	kW installed renewable capacity (electrical/ thermal)	Consider future energy prices in investment decisions	Forecasting future energy prices carries risks	Lower payback periods, greater chance to get funding
		Market-make solutions	Delivering successful projects dependent on skills matching technologies to circumstances	Chance to get early experience with new technologies and materials
		Consider risk in investment decisions	Could be politically difficult as spending seems to be 'king' at the moment	If it catches on, could lead to more stable business planning in other areas

Table 3: Actions to take

Suggested Objectives	Example Key Performance Indicator (KPI)	How to tackle it	Potential Challenges	Potential Opportunities
Mitigating the Impact on Staff	% of staff paying more than X% of income for transport	Consider swapping staff between offices	Staff might be resistant to changing workplaces	Working closer to home could lead to many other benefits for staff (more time for family etc.)
		Consider home working	IT infrastructure needs to be in place; could weaken sense of teamwork	Other benefits for staff (see above)
		Expand travel to work initiatives (car sharing, cycling)	Hard to overcome habits, most alternatives are less convenient that own car	Other benefits such as healthier living style
Managing Demand for Services	Measures of public awareness about energy issues	Determine likely demand changes	Complex interplay between prices, modes of use, alternatives, and customer behaviour	Talking to customers for this purpose could lead to a better general understanding of future needs
		Educate your customers	Potentially costly; issues often regarded as 'scare stories' and hard to convey	Chance to steer demand; have a better presence in the County
Reducing Risk of Shortages	% of services that can be continued in a >1 day blackout	Consider building local storage and generation capacity	Requires a more thorough risk analysis for the affected areas (e.g. analysing what happens to ICT services and equipment in case of a power blackout or how long can Fire & Rescue services be continued when there is a fuel shortage?)	Costly and potentially unnecessary
		Install renewable energies	See above; provides stable electricity and heat prices	See above; potentially more costly on average than external electricity and heat

Table 3: Actions to take (*continued*)

Suggested objectives	continue and increase existing activity	Energy use - heat & power: behavioural / organisational change	Energy use - heat & power: energy efficiency investment	Energy use - heat & power: renewable energy investment	Transport fuels	**Reducing risks** of power / heat outages, product / material shortages - and associated cost implications	**Mitigate impact on staff + adapt - SERVICE DELIVERERS**	**Manage demand for services - SERVICE USERS**
GENERAL / CROSS-CUTTING								
Risk based assessments								
Consider the implication on both supply chain companies and on WCC's customers *of scarcity and price increases*							✓	✓
Systematically consider vulnerability of: *Services Users / systems to power / heat outages / transport fuel scarcity*			✓	✓	✓			
Existing programmes and vulnerability: *Consider if current energy efficiency programmes are directed to achieving carbon / cost savings where there is greater vulnerability*		✓	✓	✓				
Monitoring of price changes: *Monitor price changes of key products / services to give early warning of trends*		✓	✓	✓	✓	✓		
Risk management decisions								
Consider back-up systems *to reduce vulnerability (technological / organisational)*			✓	✓	✓			
Consider future alongside energy current prices: *in the appraisal of improvement schemes with long term capital implications*			✓	✓	✓	✓		
Making decisions based on estimated future prices: *Consider future instead of current prices in the appraisal of improvement schemes.*		✓	✓	✓	✓	✓		
Consider potential for future prices rises in contractual terms: *Consider the effect of steeply rising prices when (re)negotiating contracts*		✓	✓	✓	✓	✓		

Table 4: Overview of recommendations

Suggested objectives	**continue and increase existing activity**	**Energy use - heat & power**			**Transport fuels**	**Reducing risks** of power / heat outages, product / material shortages - and associated cost implications	**Mitigate impact on staff + adapt - SERVICE DELIVERERS**	**Managing Demand for Services - SERVICE USERS**
		behavioural / organisational change	**energy efficiency investment**	**renewable energy investment**				
CONSTRUCTION - ***including maintenance programmes***								
	Invest in **awareness** raising campaigns to reduce energy use	**Incentivise** energy savings	Continue and expand the ongoing efforts to **develop efficiency & on-site generation** as economically sensible	Continue and expand the ongoing efforts to **develop efficiency & on-site generation** as economically sensible		Work together with the **supply chain** to determine likely impacts of high energy prices and develop solutions together Consider combining procurement of several sub-regional authorities to achieve greater buying power		
CATERING								
						Monitor price relationship of key commodities / products / services to give early warning of trends that might impact on delivery / policy Require contractors to provide information about the sources of products / ingredients, together with the energy used in production / delivery Consider selective sourcing of more locally grown / produced food starting with an increased awareness of current product / ingredient sources and energy used in production and delivery		

Table 4: Overview of recommendations (*continued*)

Suggested objectives	**continue and increase existing activity**	**Energy use - heat & power**			**Transport fuels**	**Reducing risks** of power / heat outages, product / material shortages - and associated cost implications	**Mitigate impact on staff + adapt - SERVICE DELIVERERS**	**Managing Demand for Services - SERVICE USERS**
		behavioural / organisational change	**energy efficiency investment**	**renewable energy investment**				
ICT								
	Continue and expand the ongoing efforts to **use more efficient devices** as economically sensible	Continue and expand behavioural change campaigns that aim to reduce unnecessary use of equipment Consider changing budget responsibilities so that the ICT department pays the bills for the electricity it uses, to then bill their clients						
COUNTY HIGHWAYS / STREET LIGHTING								
	Continue and expand the ongoing efforts to recycle material and improve lighting					Consider the use of **alternative materials**, such as vegetable binders		

Table 4: Overview of recommendations (*continued*)

Suggested objectives	**continue and increase existing activity**	**Energy use - heat & power**			**Transport fuels**	**Reducing risks** of power / heat outages, product / material shortages - and associated cost implications	**Mitigate impact on staff + adapt - SERVICE DELIVERERS**	**Managing Demand for Services - SERVICE USERS**
		behavioural / organisational change	**energy efficiency investment**	**renewable energy investment**				
TRANSPORT OPERATIONS								
	Invest in more efficient technologies when purchasing new vehicles for WCC				Work together with small and medium contractors to improve their efficiency. This can be done by setting longer contracts subject to the acquisition of more efficient vehicles			
FIRE & RESCUE								
	Continue the actions in place to measure energy consumption and adapt to climate change				Invest in **more efficient** vehicles as fleet needs replacement			
CYPF / AHCS								
Review implications of generalised findings, prioritise, undertake risk assessments activity by activity		✓	✓	✓	✓	✓	✓	✓

Table 4: Overview of recommendations (*continued*)

5.3 OTHER IMPORTANT ISSUES BEYOND THE SCOPE OF THE PROJECT

5.3.1 The list below shows a range of issues that clearly are important and related to the project in that they are related to the phenomena of UK Energy Security and Peak Oil, but were not addressed as such. These should be kept in sight and addressed as appropriate.

- Review high level corporate / public service delivery objectives against implications of findings
- Changing nature of services required
- Image / reputation
- Sustainable communities
- Local economic development

6 CLOSING REMARKS

6.1.1 The project carried out and this report as its main output are the **starting point of a long journey**. UK Energy Security and Peak Oil are issues whose impacts will be felt sometimes many years into the future, rather than now. Likewise, the actions pursued to mitigate these impacts will take many years to be implemented. It is therefore crucial to start planning now. In this report, we tried to convey this message, support it by facts and rigorous analysis and give some guidance on what to do next.

6.1.2 Though we presented UK Energy Security and Peak Oil as challenges and risks, because this is what was analysed, it should not be forgotten that they can also be viewed as **opportunities**. For instance, there are substantial synergies with de-carbonisation efforts, a topic that will undoubtedly become more important in the future. WCC has the chance to make the connections and take early action - including stepping up its work to increase its own resilience to energy scarcity and price rises - and act as an example to Warwickshire's communities and businesses.

6.1.3 We are thankful to WCC and Jonathan Horsfield in particular for the opportunity to work on this fascinating topic. Despite, or perhaps because of the challenges we encountered, the project proved a fantastic and enjoyable learning experience.

TECHNICAL APPENDICES

A List of People Who Contributed Directly to the Project
B Workshop Presentation
C Workshop Participants and Outputs
    1 Initial map designed by participants
    2 List of implications derived from the map
    3 Results of mitigation exercise
    4 Questionnaire answers from the workshop
D Scenarios (including all supporting documents in the process)
    1 Brainstorm of factors
    2 Importance/Uncertainty matrix
    3 Factor ranges
    4 Scenario 1 - Coventry Telegraph
    5 Scenario 2 - The Daily Telegraph
E Interviews
    1 Interview guides
    2 List of interviews
F Calculations for Each Service Area
G A3 Page with Key Points on UK Energy Security and Peak Oil
H Contact Details of the Authors

APPENDIX A: LIST OF PEOPLE WHO CONTRIBUTED DIRECTLY TO THE PROJECT

Below is the list of people who contributed directly to this project. We are thankful to all of them and hope they will find this work useful.

Warwickshire County Council

- Phil Evans, Head of Facilities Management - Resources
- Jonathan Horsfield, Renewable Energy Advisor - Resources
- Colin Stocker, Facilities Group Manager - Resources
- Bill Johnson, Corporate Energy Manager - Resources
- Bradley Gallagher, Energy Conservation Technical Assistant - Resources
- Julian Humphrey, Construction & Development - Resources
- Richard Hopkins, Operations & Servers Manager, ICT
- Duncan Lund, Energy Advisor - ICT
- Sandra Russell, County Catering - Resources
- Hazel Prescott, County Catering - Resources
- Stephen Trout, Fleet Vehicle Manager - EED
- Stephen Roots, Community Transport Officer - EED
- Julie Burton, Environmental Management System Officer - EED
- Andy Savage - County Highways
- Mike Cunningham, Principal Lighting Engineer - County Highways
- John Grant - County Highways
- Keith Gilks, Station Manager - Fire & Rescue
- John Key, Area Manager - Fire & Rescue
- Sandra Dean, Budget Planning Officer
- Colin Coombes - Financial Manager

External Sources (provisional list, undergoing contacts)

- George Martin, Head of Sustainable Development - Willmott Dixon Construction Group
- Peter Johnson, Director - Johnsons Coaches
- Roger Burton - AC Lloyd
- Phil Holman, Operations Manager - Hopwells
- Andrew Stanford - ESPO
- Andrew Bannister, Head of Sustainability - Pick Everard
- Stephen Ball, Sustainability Consultant - Couch Perry & Wilkes LLP
- Nicholas Radford - Carillion plc

APPENDIX B: WORKSHOP PRESENTATION

The workshop presentation including explanatory notes is provided as a Power Point file attached to this document.

APPENDIX C: WORKSHOP PARTICIPANTS AND OUTPUTS

This appendix presents the various outputs of both workshops conducted on July 19th and 22th:

Workshop 1:

Participants of the workshop: Jonathan Horsfield, Colin Stocker, Richard Hopkins, Duncan Lund, Sandra Russell, Hazel Prescott, Stephen Trout, Stephen Roots, Julie Burton, Keith Gilks and John Key.

Outputs:

1. Initial map designed by participants
2. Identified implications by service area
3. Results of mitigation exercise

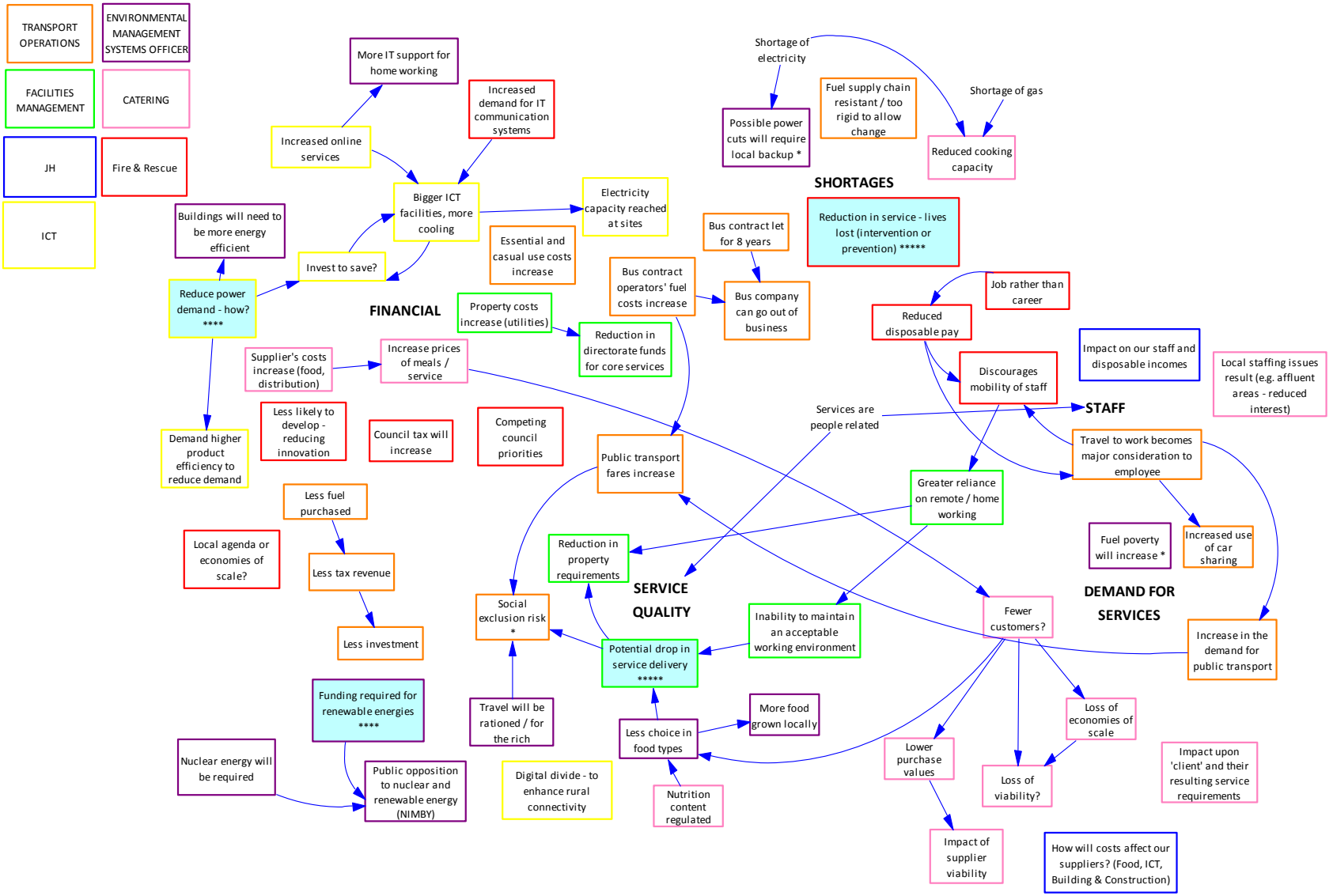
Workshop 2:

Participants of the workshop: Andy Savage, Mike Cunningham, John Grant, Nick Radford

Output:

4. Questionnaire answers

1. Initial map designed by participants



2. Identified implications by service area

Type of implication	Implications (colours indicate areas affected by the implication)
Financial	• Less funding available • Need of investment in renewable energies • Increasing competition for council priorities • Increasing gas prices • Increasing electricity prices • Increasing fuel prices • Catering suppliers' cost • Price of the meals • Loss of economies of scale • Higher property costs
Service quality	• Decrease in overall service delivery • Services less affordable • Food type choice • Public transport fares
Shortages	• Gas shortage • Petrol shortages • Increased number of black-outs and brown-outs • Not enough ICT capacity • Less capacity to prevent and intervene
Demand for services	• Less demand for public transport • Less demand for school meals • More ICT services to support home working • More demand for online services • More property requirements
Staff	• Less disposable pay • Reduce mobility of staff • More difficult to keep staff • Reliance on home working

Legend:

Catering
Transport
Facilities
ICT
Fire & Rescue
General

3. Results of mitigation exercise

This appendix transcribes the mitigation ideas generated on the Energy Security and Peak Oil workshop conducted on July 19.

Firstly there is a list of the three mitigation ideas generated by each participant in Stage A. Stage B comprises the four ideas submitted by each pair after discussion. Stage C presents the final agreement of the two groups working together.

Stage A[47]

Participant 1

I. Greater investment for renewable energy - increase funding for "green" households
II. Development of battery technology and fuel cell
III. Behavioural change - waste minimization

Participant 2

I. Financial: Identify cost component of services attributable to fuel purchase. Run scenarios
II. Staff: Behavioural change is messy/hard to manage - but if there is no big fix...?
III. Services: Up to the Authority as a placeshaper to start in-building local solutions. Otherwise, market solutions...?

Participant 3

I. Better focus on Authority's core service requirements. What must we do Vs. What we would like to do
II. Greater support/investment for modern and flexible working
III. Improve financial systems to ensure all areas have incentive to reduce energy costs

Participant 4

I. Working from nearest WCC (or other public) building when possible
II. Reduce silo approach between different directorates/services to share work/delivery
III. Deliver essential services only

Participant 5

I. Invest in new technologies to reduce older, expensive equipment which is inefficient
II. Have a clear statement from cabinet as to the priorities & stick to them
III. Make change happen, force the pace with some leadership

Participant 6

I. Rethink budget accountability
II. Political agreement to change
III. Needs major incident or issue to produce actions
IV. What services can we stop providing to invest to save?

Participant 7

I. Reduction in use of electricity → Consider incentives approach
II. Engender responsibility into the users and create a benefit culture of savings (e.g. Re-investment of % of savings)

Participant 8

I. Look into "linking" food contracts so only one company is used for all food deliveries (e.g. frozen and grocery on the same delivery run)

a. This would reduce fuel costs and less delivery lorries - may also mean higher delivery costs.

II. No "incentive" to reduce costs as overhead charges are not reduced accordingly if saves are made.

Participant 9

I. Energy awareness/reduction campaign
II. Deal with "process barriers" that get in the way
III. Identify greatest risks and implications - then prioritize corporately
IV. Target key areas for re-investment

Stage B

Pair 1 (1 and 2)

I. Greater investment in renewable energy including battery technology, fuels cells and grants for households
II. Behavioural change is messy but if there is no big fix...?
III. Up to Authority as a place-shaper to develop local solutions
IV. Identify cost component of fuel and run scenarios

Pair 2 (3 and 4)

I. Identify and deliver essential services only
II. Modern and flexible working
    a. Increased investment
    b. Better space occupancy
    c. Local working (if nearest WCC building)
III. Reduce silo approach between directorates/services especially within finance areas – cross charging, fee earning, etc.
IV. Charging for car parking!

Pair 3 (5 and 6)

I. Why do we need a major incident or issue to provoke action?
II. Can we have a clear statement from cabinet/SDLT as to the priorities and stick to them?
III. Invest - people, technologies, infrastructure, etc to make the changes/savings
IV. Make the finances more of a "building block" and less "Bob the builder"

"Pair" 4 (7, 8 and 9)

I. Intervention across WCC - engage everyone in Energy saving campaign including incentivizing staff and services
II. Reduce the number of suppliers and/or delivery days to reduce transport costs
III. Identify, prioritize risks for action - including investment

Pair 5 (10 and 11, individual sheets not available)

I. Engineering
    a. More efficient equipment
    b. More efficient ways of working
II. Systems - customer focuses
    a. What do we want to do?
    b. Are there areas of duplication?
    c. Collaboration

III. Assets
    a. Combined sites - modern design for combined services
    b. Improved/Integrated public transport system
IV. Development of personnel locally reducing the need to travel to perform roles

Stage C

Group 1 (Pairs 1, 2 and 5)

I. Joined up working across directorates/services - better use of resources
II. Behavioural change through managed programmes at both organisational and personal level
III. More efficient use of buildings/assets to make targeted energy savings
IV. Investment → Continuous improvement
V. Integrated public transport system

Group 2 (Pairs 3 and 4)

I. Develop "Champions" to drive new policies and priorities
II. Intervention across WCC - engage everyone in Energy saving campaign including incentivizing staff and services
III. Can we have a clear statement from cabinet/SDLT as to the priorities and stick to them?
IV. Identify, prioritize risks for action - including investment

4. Answers to questionnaires & discussion

1. What do you think would be the financial implications of this scenario for the area you are working in? Consider (a) materials used (b) fuel consumed (c) electricity consumed

- Delivery and production of street lighting materials would rise. Maintenance costs would increase
- Electricity - investigations into turning lights off would have to be [?]
- The way work is planned (Area programmes per year not County programmes)
- Type of work completed
- Higher prices, less work completed

2. Did oil price spikes in the past (e.g. 2008) have any significant effect on your area? For example, was there pressure from your suppliers to adjust prices?

- Street lighting electricity prices have trebled in the last 3-4 years, 5 or 6 years ago our budget was around £700,000, now it is £2.2m
- Yes - increased costs
- Increases requested regularly, suppliers use it as an excuse to increase prices

3. Do you consider the impact of the scenario on staff as relevant? For example, do many of your colleagues have a commute longer than 30 miles? *(County Highways only)*

- Fortunately the vast majority of staff live in very close proximity to their base work location

4. Does your department consider the introduction of new technologies/materials in order to increase resilience to oil prices? Are there any current/projected "efficiency improvement" measures to be introduced (e.g. Vegecol)? *(Contractor only)*

- Fleet improvements

5. Can you see any other implications for your service area?

- Reducing street lighting → Possibility off increase in crime and fear of crime and possibility of increase in traffic accidents.
- Reduced service
- Less work/reduced turnover

6. Please write down three short ideas of how to address these issues in your service area.

- Funding for replacing whole lighting schemes in areas with more efficient lighting equipment - LEDs / Cosmopolis
- Turn off any lights no longer required (and remove)
- Look at reducing operating hours of street lights
- Consider Area programmes of work
- Innovations to reduce use: Maintenance processes
- Consider other fleet options/fuel types

APPENDIX D: SCENARIOS

This appendix presents the various stages that lead to the two scenarios used in the interviews.

The scenario planning exercise starts with a brainstorm of possible factors related to the scenario in study distributed by 7 categories: Social; Political; Economic; Competition; Technology; Regulation; Environment. After this stage the factors are plotted in the importance/uncertainty matrix aiming to select the most important and less predictable and therefore, with the aspect impact (top-left corner). Finally, based on research, ranges are defined for every factor. The different scenarios are then designed based on the relative position within this range.

All the documents are presented in this appendix according to the following structure:

1. Brainstorm of factors
2. Importance/Uncertainty matrix
3. Factor ranges
4. Scenarios
   i. Scenario 1 - Coventry Telegraph
   ii. Scenario 2 - The Daily Telegraph

1. Brainstorm of factors

Social

- Migration
- Energy consumption
- Demographic trend (ageing)
- Risk of upheaval
- People living in Warwickshire
- Awareness about energy challenges
- Mileage of staff
- Online trend / ICT

Political

- Government grants / Budget
- Gas import dependency

Economic

- Investments in green tech
- Investments in energy infrastructure
- Oil price
- Food prices
- Gas prices
- Inflation
- Electricity prices
- Economic growth
- Globalisation

Competitive

- Availability of public transport
- Taxed paid

Technological

- Proliferation of electric vehicles
- State-of-the-art renewable
- Video conferencing
- Frequency of power outages
- Insulation advancements
- Critical information infrastructure (CII) breakdowns

Regulatory

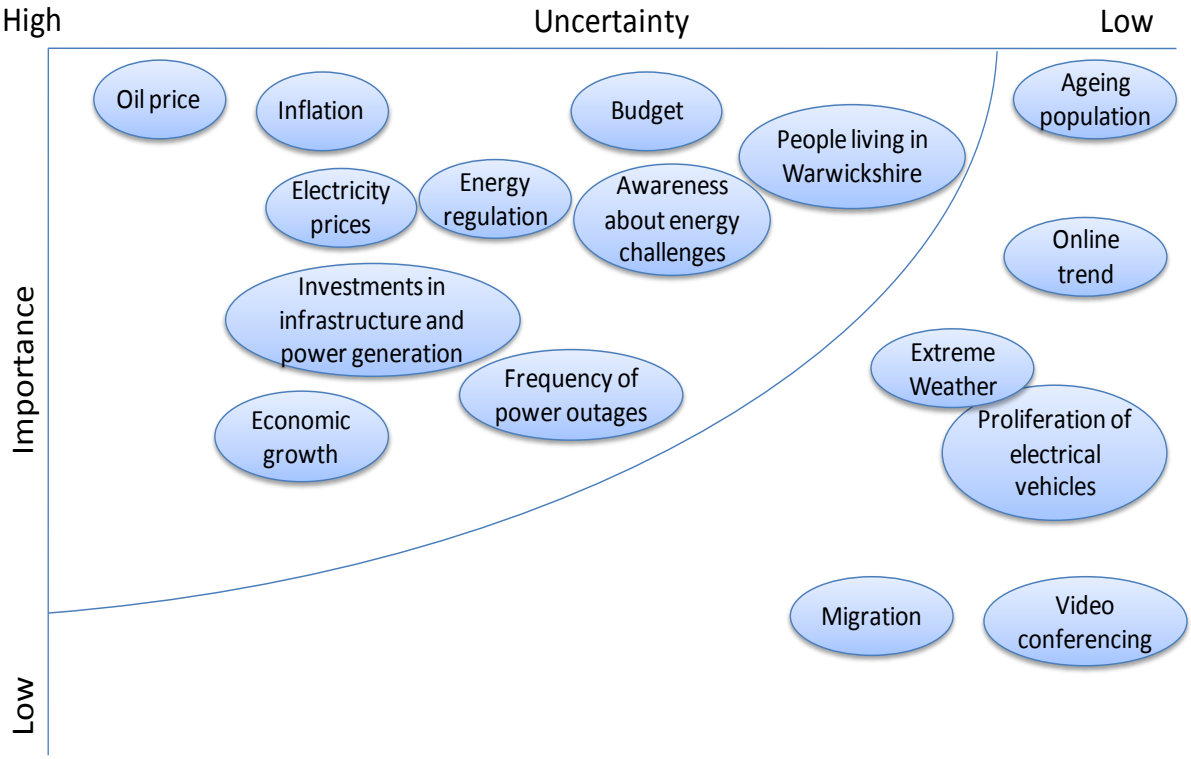
- De-carbonisation
- Energy regulation

Environmental

- Extreme weather
- Water scarcity

2. Importance/Uncertainty matrix

To select the most important and less predictable factors to use in the scenarios, they are plotted in the importance/uncertainty matrix. The objective is to select the 10-12 factors positioned in the top-left corner of the matrix.



3. Factor ranges

Scenario planning does not strictly require the factor ranges to be based on any hard data or other evidence, as the main purpose is to stretch the thinking of participants about what the future *might* hold. We nevertheless decided to give the ranges some data foundation. This will make sure that scenarios remain credible to participants and decision makers. Nevertheless, the scenarios should in no way be interpreted as any form of prediction.

Scenario Name	**1**			**2**
Factor	**Low**			**High**
Oil Price (US$/b)	150[1] (min 80)			250[2] (min 100)
Gas price (p/kWh)	5.7[3]		8.0	9.5[4]
Petrol price (p/l)	182.0[5]		250.0	303.3[6]
Electricity price (p/kWh)	14.1[7]	16.0		18.4[8]
Inflation (% p.a.)	1%[9]			3%[10]
Economic growth (% p.a.)	0%[11]	1%	2%	3%[12]
Budget (% change)	-2%[13]	-3%	-6%	-8%[14]
Energy regulation	Flexible			Strict
Frequency of power outages (p.a.)	35[15]	No mentioning	Mention Case	40[16]
Awareness about energy challenges	Low			High
People living in Warwickshire (% change)	+1.0%[17]	+0.5% 2010-2014, -1.5% in 2015	+2.5%	+3.7%[18]
Ageing population (% of 65+)	17%[19]			
Online trend	Strong			

[1] Scenario similar to oil price spike in 2008
[2] Extreme scenario to stretch thinking
[3] For residential customers, Nov 09: 3.7p/kWh (www.energy.eu); since gas price is closely related to oil price it follows the oil price scenario increase to 80% here
[4] See note 2
[5] Current (Jun 10): 118.3p/l (www.petrolprices.com), since petrol prices are closely related to the oil price they follow the oil price scenario increase to 80% here
[6] See note 3
[7] Nov 09: 11.5p/kWh (www.energy.eu), Ofgem Scenario 'Green transition' increase of 23% by 2020 (consumer bills, incl. gas)
[8] Nov 09: 11.5p/kWh (www.energy.eu), Ofgem Scenario 'Dash for Energy' increase of 60% by 2020 (consumer bills, incl. gas)
[9] Bank of England inflation report (www.bankofengland.co.uk)
[10] See note 9
[11] See note 9
[12] See note 9
[13] Arbitrary; Medium Term Financial Plan offers some guidance on budget development, but income is very dispersed (council taxes, government grants for specific projects), so that values that match the scenarios are hard to derive from this plan
[14] See note 13
[15] Below scenario from 2007/2008 but increasing in comparison to historical data as the grid is old and Winter is expected to be more severe (www.nationalgrid.com).
[16] See note 15.
[17] In the five years from 2003 to 2008 (Warwickshire Observatory), the population increased by about 3.7%
[18] See note 17
[19] Information published by the Office for National Statistics (www.statistics.gov.uk)

The main drivers for the scenarios were oil and electricity prices. Only two scenarios were created as a higher number might overstrain the time available to interviewees. The first scenario is a 'similar-to-2008' scenario, with consistently high oil prices and a spike in 2015. The second scenario is designed to elicit how extreme price developments might impact on WCC. The table shows which scenario assumes which values for each factor.

4. Scenarios

The next two pages present both scenarios created for the interviews.

i. Scenario 1 - Coventry Telegraph
ii. Scenario 2 - The Daily Telegraph

Coventry Telegraph
THURSDAY, JULY 9, 2015 www.coventrytelegraph.net 50p

$150 per barrel of oil - are we facing a new energy crisis?

Thursday, 9 July 2015. Not just petrol prices were sent soaring this week as the price of Brent crude oil hit $150 per barrel. While motorists are now paying up to 182p for a litre of unleaded fuel, households and enterprises face steep increases in their energy bills, too. At 5.7p/kWh, gas is 50% more expensive than five years ago (3.7p). Escalating electricity prices worsened the situation for consumers even further: they increased by more than a third since 2010 from 11.5 to 16p/kWh.

As yet, the UK's economic recovery seems to hold up surprisingly well to the looming energy crunch. A Treasury official stated yesterday that the government expects nominal GDP to grow by 2% in 2015, with an inflation of just 1%. The spokesman said further that in the light of these figures, government will stick to its target of cutting national and local public budgets by a further 3% this year, after having realised a reduction of

over 25% over the past five years. However, economists warn that the already shaky economic recovery may be soon come to an abrupt ending. 'The public is simply not aware of the role energy plays in our lives and the challenges presented to us', says Prof Andrew Oswald from the University of Warwick, who analyses the relationship between oil prices and unemployment. 'We have seen oil prices stay above $80 per barrel consistently during the last few years and we know from the oil price spike in 2008 that this will have knock-on effects for the whole economy. In combination with other pressures such as our ageing population, expensive energy will put public finances and the local economy in peril.'

Warwickshire has now had a flavour of what an energy crunch could mean for the county. Last month's hours-long power outage affected businesses, individuals, and the public services. While in the past, such power outages were typically caused by technical failures or extreme weather, National Grid stated that the June 2015 outage was the result of a capacity shortage with ageing coal and nuclear power stations starting to shut down.

How will Warwickshire and Coventry's residents and businesses deal with these new challenges of more frequent power outages and soaring energy prices?

Find more information on this and other issues on our online portal: www.coventrytelegraph.net

The Daily Telegraph

Oil price reaches new highs at $250

Thursday, 9 July 2015.

The National Cabinet is expected to take extraordinary measures during a meeting this afternoon as oil price reaches a new high of $250/barrel.

The escalating trend was compounded by OPECs announcement yesterday of a 5% cut in production. Following the meeting, the Emir of Qatar, Al Thani described his concern over the current rates of exploration, and declared the intent to save their resources for "our future generations". This cut puts extra pressure on the commodities market with oil prices continuing to rise for the 12th consecutive month after being concisely above $100 since 2011.

This is the latest in a chronicle of unfortunate events for the UK, which now faces a particularly difficult period of stagnant economic growth at an annual rate of 1% with inflation at 2% per year, driven in particular by oil and food prices.

Three years after the announced investments in distribution infrastructure and power generation this bleak outlook places considerable strain on government plans. Despite the successful campaign to build awareness about energy challenges, the public are angry and losing faith as energy bills continue to rise. Indeed, electricity prices have risen more than 50% since 2010, to 18.4p/kWh (11.5p) with gas prices more than doubling to 8p/kWh (3.7p).

In a society with an increasing number of elderly people counting on their pensions and families already reeling under the austerity of recent years this implies increasingly smaller disposable incomes each month. Moreover, drivers and businesses relying on transport are also suffering the effects of peaking prices, forced to pay 250p per litre of fuel every time they refuel their vehicles.

Faced with these deteriorating circumstances, the Cabinet is expected to cut the local authorities' budget. Energy related costs are also expected to drop with the introduction of the government's rationing policy for energy usage. When interviewed, the Energy and Climate Change Secretary admitted to introducing this strict regulation as "we are facing a period of unprecedented hardship requiring an active role for government and local authorities in order to overcome this challenge."

A Warwickshire County Council representative at yesterday's Local; Government Association Conference commented on the effects of these events on his county, expressing his evident concern: "Oil prices at this level represent not only a financial challenge but also social and demographic ones.

People are changing their decisions about how to spend their money and where to live because of falling disposable incomes and travel distances to work.

Since 2010 we have been noticing a shift with people moving from rural areas to more urban areas of the county."

These issues will be in discussion in Number 10 Downing Street, with new measures expected to be announced in the near future.

APPENDIX E: INTERVIEWS

1. General interview guide

The following points were designed to serve as guidelines for the conducted interviews. Interview guides were adjusted to the individual interviewees.

- **What are the implications for your service area?**
  - Financial
    - Direct impact (higher costs)
      - Materials
      - Transport operation involved in construction
    - Volatility
    - Budget
  - Staff (own and contractor)
    - Do many have a commute longer than 20 miles?
    - Do you think this will lead people to switch jobs?
  - Demand for services / types of buildings
  - Supply shortages - do they pose any risk to the service?
    - Cost of the delay?
  - Can you think of any other implications?

- **Mitigation options**
  - Name the five most important actions that would help mitigate the impact of rising energy prices
  - Thinking aids:
    - Use implications as orientation - try to relate solutions to the problems
    - Efficiency improvements
      - Insulation
    - On-site generation
      - Heat
      - Electricity
      - Means:
        - Biomass
        - Solar panels
        - Wind
  - How are such investment decisions made? What energy price is assumed?

2. List of interviews

- Julian Humphrey, Head of Development & Construction – WCC (July 26th)
- George Martin, Head of Sustainable Development – Willmott Dixon Construction (August 8th)
- Bill Johnson, Corporate Energy Manager – WCC (August 8th)
- Andrew Stanford - ESPO (August 16th)
- Phil Holman, Operations Manager - Hopwells plc (August 16th)
- Roger Burton, Construction Director - AC Lloyd (August 17th)
- Peter Johnson, Operations Manager - Johnsons Coaches (August 17th)
- Stephen Ball, Sustainability Consultant - Couch Perry & Wilkes Llp (August 19th)

APPENDIX F: CALCULATIONS FOR EACH SERVICE AREA

The background calculations for the financial risk analysis of each service area are presented on the following pages. The Excel workbook containing all calculations has also been attached electronically.

The calculations are based on the price scenarios presented in Section 3.2.11 to 3.2.13 and Table 2 of the report.

County Buildings and Area Offices*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		415,881.17	565,810.59	493,875.75	563,805.00	691,426.05	790,201.20	+197,550.30	+296,325.45
Heating	Gas		179,616.02	259,808.11	261,495.19	260,843.00	405,317.54	562,214.66	+143,822.35	+300,719.47
	Heating oil		136.99	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Transport	Fuel		0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Materials	n/a		0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Contracts & Services	n/a	1	0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Affected	Subtotal		595,634.18	825,618.70	755,370.94	824,648.00	1,096,743.59	1,352,415.86	+341,372.65	+597,044.92
Unaffected	All other costs		4,570,460.37	4,956,858.28	4,907,837.84	4,838,221.92	5,398,621.62	5,644,013.52	+490,783.78	+736,175.68
Total	**Total expenditure**		**5,166,094.55**	**5,782,476.98**	**5,663,208.78**	**5,662,869.92**	**6,495,365.22**	**6,996,429.37**	**+832,156.44**	**+1,333,220.59**
	% affected		*11.53%*	*14.28%*	*13.34%*	*14.56%*	*16.89%*	*19.33%*		
	% increase								*+14.69%*	*+23.54%*
	% increase p.a. compounded								*+2.78%*	*+4.32%*

Notes:

***** County Buildings and Area Offices only includes 23 of the over 400 buildings administered by the council or related organisations.
The majority of other buildings are schools, but also include fire stations, libraries and other buildings.
Figures from Financial Manager

a Actual spending

b Budget

1 Area offices reported minor spending on Bus/Rail fares and Car parking and also budgeted £3,500 in 2010-11 for this item. This is ignored here.

Catering*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		71,883.20	8,491.81	13,258.13	14,400.00	18,561.38	21,213.01	+5,303.25	+7,954.88
Heating	Gas		0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
	Heating oil		0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Transport	Fuel	1	84,396.41	95,756.92	97,043.29	81,970.00	135,860.61	194,086.58	+38,817.32	+97,043.29
Materials	n/a									
Contracts & Services	Food Contract, of which	2								
	Electricity	3	26,767.99	30,141.07	32,064.07	32,736.87	44,889.70	51,302.51	+12,825.63	+19,238.44
	Fuel	4	61,794.19	69,580.99	74,020.24	75,573.42	103,628.34	148,040.48	+29,608.10	+74,020.24
	Food and other	5	2,759,096.13	3,106,775.00	3,304,986.75	3,374,335.71	3,965,984.10	4,626,981.45	+660,997.35	+1,321,994.70
Affected	Subtotal		3,003,937.91	3,310,745.79	3,521,372.48	3,579,016.00	4,268,924.12	5,041,624.03	+747,551.64	+1,520,251.55
Unaffected	All other costs		6,296,946.19	6,408,435.64	6,052,855.56	5,859,191.22	6,658,141.12	6,960,783.89	+605,285.56	+907,928.33
Total	**Total expenditure**		**9,300,884.10**	**9,719,181.43**	**9,574,228.04**	**9,438,207.22**	**10,927,065.24**	**12,002,407.92**	**+1,352,837.20**	**+2,428,179.88**
	% affected		*32.30%*	*34.06%*	*36.78%*	*37.92%*	*39.07%*	*42.01%*		
	% increase								*+14.13%*	*+25.36%*
	% increase p.a. compounded								*+2.68%*	*+4.62%*
Number of days		6	182	196	183	193				
Total spending on food and milk			*2,847,658.30*	*3,206,497.06*	*3,411,071.06*	*3,482,646.00*				
Per school day			*15,646.47*	*16,359.68*	*18,639.73*	*18,044.80*				

Notes:

***** Catering - Figures from Financial Manager, Resources Directorate
a Actual spending
b Budget
1 Includes CA21 'Fuel for Vehicles', CE11 'Essential User Mileage', and CE21 'Casual Mileage'
2 Includes DB40 'Food', DB41 'Milk in Schools', DB50 'Sub contract delivery of meals'
3 Calculated from Hopwells data: 0.94% of sales are spent on electricity (implicitely assumes that dry foods providers spent equal amounts on electricity)
4 Calculated from Hopwells data: 2.17% of sales are spent on transport fuel (implicitely assumes that dry foods providers spent equal amounts on fuel)
5 Total spending on food and milk (see 2) minus 3 and 4
6 Trends in food prices should be analysed knowing that there are different numbers of school days in each year

ICT*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		0.00	0.00	0.00	n/a	0.00	0.00	+-0.00	+-0.00
Heating	Gas		0.00	0.00	0.00	n/a	0.00	0.00	+-0.00	+-0.00
	Heating oil		0.00	0.00	0.00	n/a	0.00	0.00	+-0.00	+-0.00
Transport	Fuel	1	26,206.92	28,958.85	1,338.45	n/a	1,873.83	2,676.90	+535.38	+1,338.45
Materials	Computer Hardwa	2	414,074.20	2,078,781.57	1,600,331.28	n/a	1,600,331.28	1,600,331.28	+-0.00	+-0.00
Contracts & Services	n/a									
Affected	Subtotal		440,281.12	2,107,740.42	1,601,669.73	0.00	1,602,205.11	1,603,008.18	+535.38	+1,338.45
Unaffected	All other costs		8,646,751.45	14,514,162.94	15,406,085.49	n/a	16,946,694.04	17,716,998.31	+1,540,608.55	+2,310,912.82
Total	**Total expenditure**		**9,087,032.57**	**16,621,903.36**	**17,007,755.22**	**0.00**	**18,548,899.15**	**19,320,006.49**	**+1,541,143.93**	**+2,312,251.27**
	% affected		*4.85%*	*12.68%*	*9.42%*	*n/a*	*8.64%*	*8.30%*		
	% de-/increase								*+9.06%*	*+13.60%*
	% de-/increase p.a. compounded								*+1.75%*	*+2.58%*

Notes:

***** ICT figures from Financial Manager
a Actual spending
b Budget
1 Fuel and Casual Mileage
2 2007-08 figure not representative according to financial manager; inflation rate for computer equipment not yet determined, relationship to energy prices unclear

County Highways*

Category	Product Type	Notes	2004-05a	2005-06a	2006-08a	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity	1	1,100,000.00	1,211,631.00	1,333,735.00	1,647,650.00	2,588,195.00	2,380,269.00	2,879,366.00	3,332,376.60	3,808,430.40	+952,107.60	+1,428,161.40
Heating	Gas		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
	Heating oil		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
Transport	Fuel		470,000.00	474,155.00	474,380.00	477,627.00	482,568.00	479,133.00	480,000.00	670,786.20	958,266.00	+191,653.20	+479,133.00
Materials	Bitumen		2,500,000.00	2,500,000.00	2,500,000.00	2,500,000.00	2,500,000.00	2,500,000.00	2,500,000.00	3500000.00	4000000.00	+1,000,000.00	+1,500,000.00
	Surface Dressing Binder		600,000.00	600,000.00	600,000.00	600,000.00	600,000.00	600,000.00	600,000.00	840000.00	960000.00	+240,000.00	+360,000.00
	Microasphalt		0.00	0.00	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	700000.00	800000.00	+200,000.00	+300,000.00
	Other High Oil		1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1400000.00	1600000.00	+400,000.00	+600,000.00
Contracts & Services	n/a, included above									0.00	0.00	+-0.00	+-0.00
Affected	Subtotal		5,670,000.00	5,785,786.00	6,408,115.00	6,725,277.00	7,670,763.00	7,459,402.00	7,959,366.00	10,443,162.80	12,126,696.40	+2,983,760.80	+4,667,294.40
Unaffected	All other costs	2	10,345,121.00	8,766,913.00	11,200,693.00	11,496,729.00	13,344,634.00	12,452,867.00	12,920,000.00	13,698,153.70	14,320,797.05	+1,245,286.70	+1,867,930.05
Total	**Total expenditure**		**16,015,121.00**	**14,552,699.00**	**17,608,808.00**	**18,222,006.00**	**21,015,397.00**	**19,912,269.00**	**20,879,366.00**	**24,141,316.50**	**26,447,493.45**	**+4,229,047.50**	**+6,535,224.45**
	% affected		*35.40%*	*39.76%*	*36.39%*	*36.91%*	*36.50%*	*37.46%*	*38.12%*	*43.26%*	*45.85%*		
	% increase											*+21.24%*	*+32.82%*
	% increase p.a. compounded											*+3.93%*	*+5.84%*

Notes:

***** County Highways is part of Environment & Economy. Its main responsibility is the maintenance of the county's road network.
blue Indicative figures
a Actual spending
b Budget
1 Contains Street Lighting only

Transport*

Category	Product Type	Notes	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		91,257.24	127,974.03	145,800.00	179,163.64	204,758.45	+51,189.61	+76,784.42
Heating	Gas	1	0.00	0.00	0.00	0.00	0.00	+-0.00	+-0.00
	Heating oil					0.00	0.00	+-0.00	+-0.00
Transport	Fuel		351,917.23	330,451.99	310,561.00	462,632.79	660,903.98	+132,180.80	+330,451.99
Materials						0.00	0.00	+-0.00	+-0.00
Contracts & Services						0.00	0.00	+-0.00	+-0.00
Affected	Subtotal		443,174.47	458,426.02	456,361.00	641,796.43	865,662.43	+183,370.41	+407,236.41
Unaffected	All other costs		n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total	**Total expenditure**	2	**443,174.47**	**458,426.02**	**456,361.00**	**641,796.43**	**865,662.43**	**+183,370.41**	**+407,236.41**
	% affected		*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*		
	% de-/increase							*+40.00%*	*+88.83%*
	% de-/increase p.a. compounded							*+6.96%*	*+13.56%*

Notes:

***** Transport - All figures from financial manager; 2009-10 figures labeled 'year to date'
a Actual spending
b Budget
1 Unlikely, but no data received
2 No data about total expenditure available

Fire&Rescue*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		85,132.68	137,122.49	126,867.55	n/a	177,614.57	202,988.08	+50,747.02	+76,120.53
Heating	Gas		63,104.45	123,384.70	102,357.50	n/a	158,654.13	220,068.63	+56,296.63	+117,711.13
	Heating oil		0.00	0.00	0.00	n/a	0.00	0.00	+-0.00	+-0.00
Transport	Petrol and Oil	1	83,312.12	93,527.42	113,351.44	100,000.00	158,692.02	226,702.88	+45,340.58	+113,351.44
Materials	n/a						0.00	0.00	+-0.00	+-0.00
Contracts & Services	n/a									
Affected	Subtotal		231,549.25	354,034.61	342,576.49	100,000.00	494,960.71	649,759.59	+152,384.22	+307,183.10
Unaffected	All other costs		24,098,333.79	25,197,237.38	23,297,992.51	n/a	25,627,791.76	26,792,691.39	+2,329,799.25	+3,494,698.88
Total	**Total expenditure**		**24,329,883.04**	**25,551,271.99**	**23,640,569.00**	**100,000.00**	**26,122,752.47**	**27,442,450.97**	**+2,482,183.47**	**+3,801,881.97**
	% affected		*0.95%*	*1.39%*	*1.45%*	*100.00%*	*1.89%*	*2.37%*		
	% de-/increase								*+10.50%*	*+16.08%*
	% de-/increase p.a. compounded								*+2.02%*	*+3.03%*

Notes:

***** F&R - Figures from Finance Officer, Warwickshire Fire & Rescue Services
a Actual spending
b Budget
1 Figures directly from Area Manager

CYPF*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2010-11f	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity	1	144,000.00	178,000.00	188,000.00	223,000.00	208,000.00	263,200.00	300,800.00	+75,200.00	+112,800.00
Heating	Gas	1	147,000.00	195,000.00	192,000.00	199,000.00	187,000.00	297,600.00	412,800.00	+105,600.00	+220,800.00
	Heating oil	1	15,000.00	31,000.00	21,000.00	0.00	21,000.00	37,800.00	58,800.00	+16,800.00	+37,800.00
Transport	Fuel							0.00	0.00	+-0.00	+-0.00
	Fuel oil										
Materials	n/a							0.00	0.00	+-0.00	+-0.00
Contracts & Services	Bus Contracts	2				17,236,779.00					
Affected	Subtotal		306,000.00	404,000.00	401,000.00	17,658,779.00		598,600.00	772,400.00	+197,600.00	+371,400.00
Unaffected	All other costs	3	78,130,000.00	81,564,000.00	103,916,000.00	87,587,419.50		114,307,600.00	119,503,400.00	+10,391,600.00	+15,587,400.00
Total	**Total expenditure**		**78,436,000.00**	**81,968,000.00**	**104,317,000.00**	**105,246,198.50**		**114,906,200.00**	**120,275,800.00**	**+10,589,200.00**	**+15,958,800.00**
	% affected		*0.39%*	*0.49%*	*0.38%*	*16.78%*		*0.52%*	*0.64%*		
	% de-/increase									*+10.15%*	*+15.30%*
	% de-/increase p.a. compounded									*+1.95%*	*+2.89%*

Notes:

***** CYPF: budget figures from overall budget report, actual and forecasts from Directorate Financial Manager
a Actual spending
b Budget
f Forecast
1 Majority of energy costs relate to Youth Services with a total budget of £3.8m
2 2007 to 2010 based on overall budget report

Adult, Health and Community Services*

Category	Product Type	Notes	2007-08a	2008-09a	2009-10a	2010-11b	2014-2015 Base Scenario	2014-2015 Stress Scenario	Change 09-10 to 14-15 Base Scenario	Change 09-10 to 14-15 Stress Scenario
Power	Electricity		185,503.27	197,359.32	207,149.68	246,280.00	290,009.55	331,439.49	+82,859.87	+124,289.81
Heating	Gas		212,065.01	275,582.71	239,962.57	250,890.00	371,941.98	515,919.53	+131,979.41	+275,956.96
	Heating oil		1,961.75	2,794.28	2,328.85	0.00	4,191.93	6,520.78	+1,863.08	+4,191.93
Transport	Fuel	1	18,819.85	18,704.99	16,478.44	17,947.00	23,069.82	32,956.88	+6,591.38	+16,478.44
Materials	n/a						0.00	0.00	+-0.00	+-0.00
Contracts & Services	n/a	2								
Affected	Subtotal		418,349.88	494,441.30	465,919.54	515,117.00	689,213.28	886,836.67	+223,293.74	+420,917.13
Unaffected	All other costs	3	159,976,822.60	163,159,631.87	170,800,261.73	168,113,121.00	187,880,287.90	196,420,300.99	+17,080,026.17	+25,620,039.26
Total	**Total expenditure**		**160,395,172.48**	**163,654,073.17**	**171,266,181.27**	**168,628,238.00**	**188,569,501.18**	**197,307,137.66**	**+17,303,319.91**	**+26,040,956.39**
	% affected		*0.26%*	*0.30%*	*0.27%*	*0.31%*	*0.37%*	*0.45%*		
	% de-/increase								*+10.10%*	*+15.20%*
	% de-/increase p.a. compounded								*+1.94%*	*+2.87%*

Notes:

***** AHCS: all figures from general ledger for Adult Social Care, which is probably why figures contradict budget report for AHCS
a Actual spending
b Budget
1 Much more reported in budget report (£235,000), but says 'now bus contracts'
2 Should include bus contracts, but no data available
3 Includes items that are almost certainly influenced as well - e.g. external residential care (49m), external homecare (16m)

APPENDIX G: A3 PAGE WITH KEY POINTS ON UK ENERGY SECURITY AND PEAK OIL

An informative folded A3 brochure about UK Energy Security and Peak Oil has been attached as electronic document.

APPENDIX H: CONTACT DETAILS OF THE AUTHORS

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NOTES AND REFERENCES

Quotes:
Christophe de Margerie, CEO Total:
http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aTv00Tc4yhSA

Tony Blair:
http://www.independent.co.uk/news/uk/home-news/protesters-give-blair-60-day-ultimatum-699113.html

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[1] 2007 Data from World Bank, World Development Indicators, see: http://data.worldbank.org/data-catalog/world-development-indicators?cid=GPD_WDI

[2] BOE vs. human labour: The current energy consumption per capita in the UK is 3,464kg boe (2007) which is equivalent to c.25 barrels of oil (data: World Bank, World Development Indicators, see http://data.worldbank.org/data-catalog/world-development-indicators?cid=GPD_WDI). For rough calculations about the energy content of human labour, see: http://www.theoildrum.com/node/4315. Much depends on this calculation, and results can vary substantially. Also, a barrel of oil contains a lot of energy, but it of course does not contain ingenuity, passion and other things that humans contribute to society.

[3] See for example recent report by the UK Energy Research Centre analysing over 500 studies on Peak Oil

[4] List of participants, presentation and the analysed outputs of both workshops in Appendices B and C

[5] Both scenarios and the documentation of the process leading to it can be found in Appendix D

[6] The economics of Energy efficiency, Michael Toman (1995)

[7] Data from DECC, The Low Carbon Transition Plan. Available: http://centralcontent.fco.gov.uk/central-content/campaigns/act-on-copenhagen/resources/en/pdf/DECC-Low-Carbon-Transition-Plan [Accessed August 14, 2010].

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Loss in transmission figure (9% in text box) from http://www.earth.org.uk/note-on-UK-grid-CO2-intensity-variations.html [Accessed August 20, 2010]

[10] Ofgem press release. Available: http://www.ofgem.gov.uk/media/pressrel/Documents1/Ofgem%20-%20Discovery%20-%20PR8%20(2).pdf [Accessed August 20, 2010].

[11] DECC. UK Monthly Oil Production (M3) [Online Database]. Available: https://www.og.decc.gov.uk/pprs/full_production.htm [Accessed August 14, 2010].

[12] Campbell, C. The growing gap [Graph]. Available: http://www.theoildrum.com/files/campbelldiscoverycurve200903_0.gif [Accessed August 14, 2010].

[13] Includes crude oil, shale oil, oil sands and Natural Gas Liquids (NGLs), excludes liquids from other sources such as biomass and coal derivatives

[14] Forecasts compiled by UK Energy Resource Centre in their recent report *Global Oil Depletion* (2009)

[15] Compiled in *Sustainable Energy Security* by Lloyds and Chatham House

[16] Data: Oil prices: BP Statistical Review of World Energy 2010; GDP: Office for National Statistics

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[26] Based on the workshop discussions and mapping from July 19, 2010.

[27] Suggested in several personal interviews, e.g. with Bill Johnson on August 9, 2010 and with Julian Humphrey on July 26, 2010

[28] Suggestions made at workshop on July 19, 2010, in particular by Sandra Russell and Hazel Prescott if not indicated otherwise

[29] Personal interview with Phil Holman, Operations Manager at Hopwells, on August 16, 2010

[30] Suggestions made at workshop on July 19, 2010, in particular by Sandra Russell and Hazel Prescott if not indicated otherwise

[31] Suggestions made at workshop on July 19, 2010

[32] Suggestions made at workshop on July 19, 2010

[33] Suggestions made at workshop on July 19, 2010

[34] Based on personal interview with Julian Humphrey, Design and Construction, on July 26, 2010

[35] Based on personal interview with Julian Humphrey, Design and Construction, on July 26, 2010

[36] Suggestions made at workshop on July 22, 2010 and in questionnaires distributed at this workshop

[37] Compiled by Andy Savage, County Highways, following the presentation on UK Energy Security and Peak Oil on July 22, 2010

[38] Data from personal interview with Peter Johnson, Operations Manager at Johnsons Coaches

[39] Personal Interview with Peter Johnson, Operations Manager at Johnsons Coaches, about the implications of rising energy prices

[40] Personal Interview with Peter Johnson, Operations Manager at Johnsons Coaches, about the implications of rising energy prices

[41] Suggestions made at workshop on July 19, 2010

[42] Suggestions made at workshop on July 19, 2010

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[47] Two of the Stage A sheets were missing and so there is no record for participants 11 and 12. Despite this fact, their opinion is registered under “Pair 5” for Stage B as they were working together.