Appendix

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TPA Report on Medium Term Economic Outlook

Economic and Pricing Assumptions
A Report for Northern Gas Networks

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1. Introduction

This report provides the background to the development of the detailed assumptions that have been provided to Northern Gas Networks (NGN) as one part of their input to the NGN Business Plan.

These assumptions have been developed as a Base Case and one High and one Low Scenario. The original NGN requirement for this work is given in Appendix 1.

In addition the report provides an analysis of the impact of changing consumer behaviour on the annual/peak relationship resulting from the introduction of new technology and improved energy efficiency. This section includes analysis of the impacts of alternative gas sources on the NGN network.

Finally there is an overview of the application of the analysis provided in this report to the longer term up to 2050.

2. Economic Assumptions

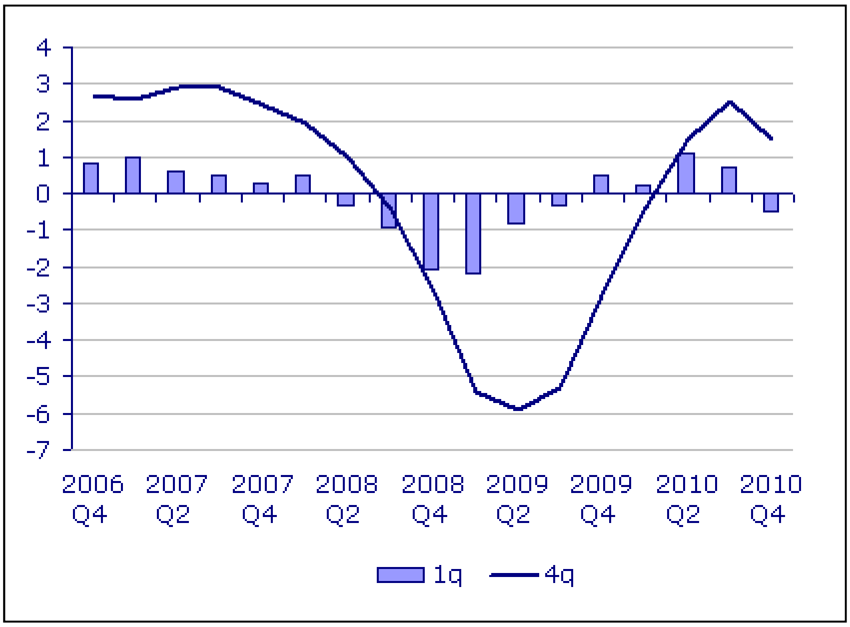
2.1. General Background

This section provides a general overview of the UK economy to give some context to the Regional data that will be provided in this report.

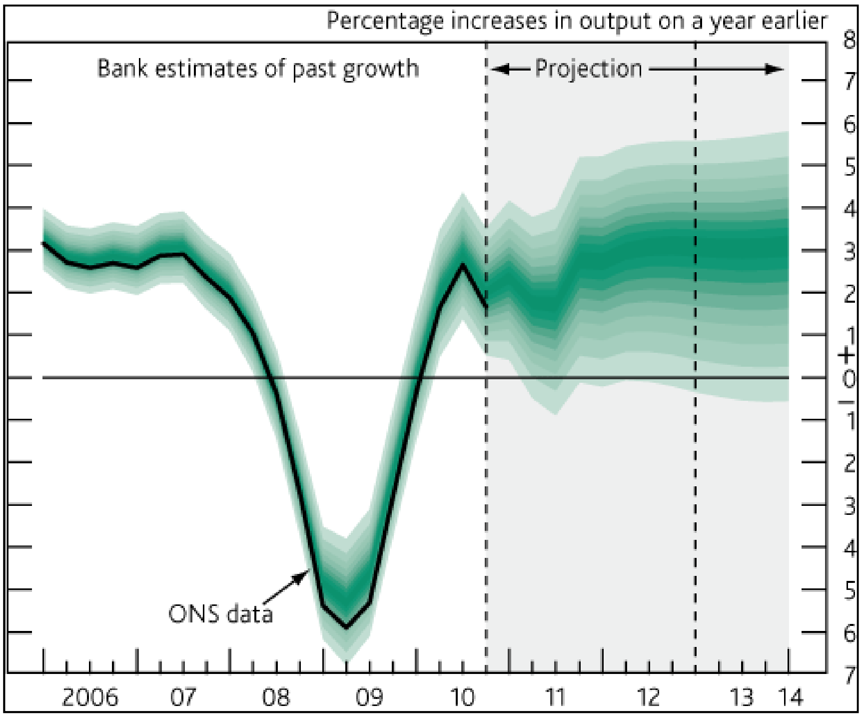
2.1.1. UK Gross Domestic Product(GDP) and Gross Value Added(GVA)

Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of Gross Domestic Product (GDP). GDP is a key indicator of the state of the whole economy and equates to GVA plus taxes on products minus subsidies on products. A significant decline in GDP occurred during 2008 set against a long period of growth from 1992. However as with manufacturing there has been some recovery in GDP during the early part of 2010 (see below).

The latest economic figures below show a substantial recovery in the third quarter of 2010, followed by a dip in the last quarter. There is clearly a long way to go but on the basis of the current trend it would be expected that the economy may be stabilised by the end of 2011 and start to show signs of more recovery in 2013.



The Bank of England projections of GDP are very widely spread (see below) and to some degree reflect the recent dip in the economy so could be viewed as not presenting an overly optimistic picture in the very short term.



2.1.1. Household disposable income

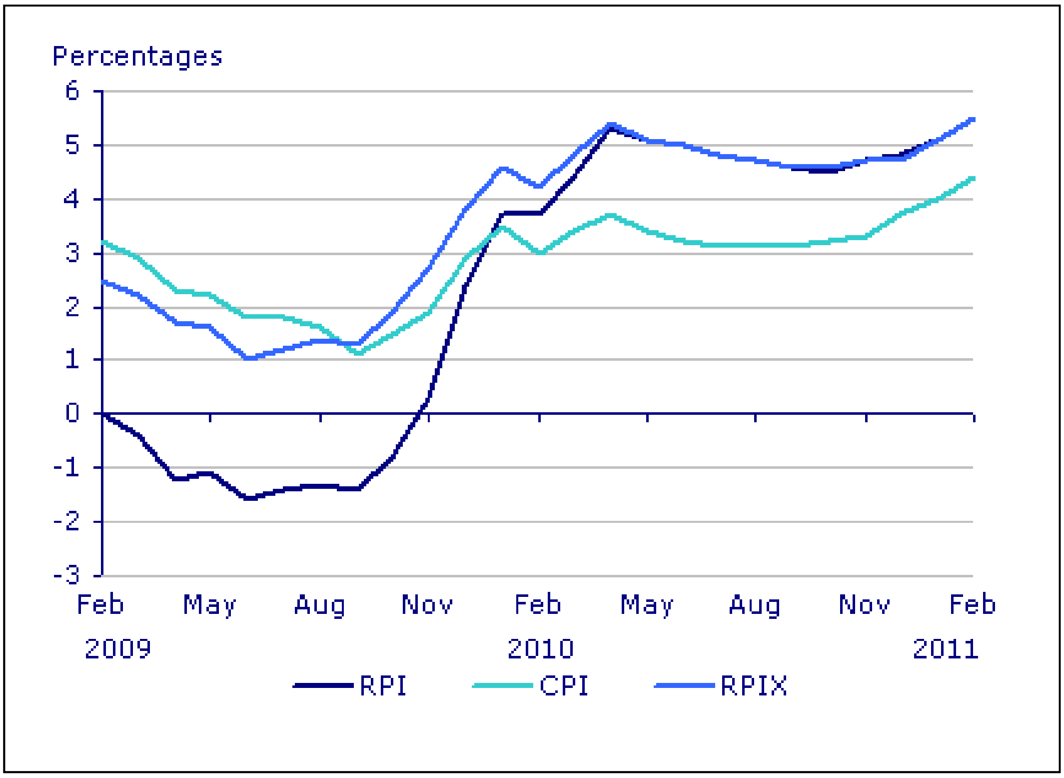
This can be used as an indicator of householders' ability to absorb rising energy prices and provides a reasonable indication of how affluent households are in a particular area. The source of this data is the National Statistics Office NUTS 1:1 table. Figures for GB are available as provisional figures up to 2009 and the figures for the North East have been taken as representative of the NO LDZ and Yorkshire and the Humber as representative of the NE LDZ.

2.1.2. Manufacturing Output

Manufacturing Output trends provide an assessment of how this type of industry is performing. There has been a significant downturn in manufacturing over the last year according to the National Statistics Office on the back of what has been a steady increase since 2003 (see below). However there has been an upturn during 2010, suggesting some small recovery.

2.1.3. Inflation

After a period of relative low Retail Price Index (RPI), Consumer Price Index (CPI) and RPIX (RPI minus mortgage payments) during the first three quarters of 2009 all indices are showing that they have been rising sharply in the last quarter of 2009 and continue to rise during 2010 and into 2011 (see below).



2.2 NGN Economic Assumptions

2.2.1 National GVA[1]

GB GVA growth is assumed to be flat at last year's rate (1.49%) for two more years as GB struggles to recover from the recession and then returns to the same three year economic cycle that has been experienced with an average rate equal to the long term non-recessionary average.

2.2.2 Regional GVA[2]

The GVA for North East have been taken as representative of the NO LDZ and Yorkshire and the Humber as representative of the NE LDZ. The figures used for 2010 are estimates as official regional figures were not available at the time the forecasts were produced.

GVA growth in both LDZs has been below the average growth for GB in the period 1990 to 2009, with the impact of the recession being felt at the same time as GB and being marginally more severe in both 2008 and 2009.

GVA growth for NE LDZ is assumed to be flat at last year's GB rate for two more years (as the NE LDZ has a similar historical growth profile as GB GVA) as the NE LDZ area struggles to recover from the recession and then returns to the same three year economic cycle that has been experienced with an average rate equal to the long term non-recessionary average.

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[1] GB GVA is at 2006 prices
[2] All Regional GVA categories are at 2006 prices

GVA growth for NO LDZ is assumed to be flat at last year's GB rate (adjusted pro-rata to long term average rate for NO LDZ compared to NE LDZ) for two more years as NO struggles to recover from the recession and then returns to the same three year economic cycle that has been experienced with an average rate equal to the long term non-recessionary average.

The Commercial and Services sector has seen substantial growth in both LDZs over many years only being halted by the recession. It is expected to recover in line with regional GVA.

The Manufacturing sector in both LDZs has seen a cycle of rise and fall over the last 20 years but the general trend is downwards and is expected to continue to decline but showing some signs of the historical cycle of rise and fall as recovery in the manufacturing sector nationally is reflected in the Northern half of England.

The Industrial sector (which includes Construction) has seen a similar cycle of rise and fall as Manufacturing but the general trend is upwards over the last 20 years. It is expected to recover to counter some of the losses in Manufacturing with a good contribution from the Construction sector as new housing recovers and there is new development around the ports associated with the growth in offshore wind developments.

2.2.3 Household disposable income (GDHI)[3]

The figures used for 2010 are estimates as official figures were not available at the time the forecasts were produced. The growth assumed for 2010 is the same as 2009 as the economy recovers slowly, however the following two years sees a decline in growth back to the level of the recession as Public Sector cuts bite increasingly over that period. Slow recovery after this to 2% growth nationally by 2015.

2.2.4 Inflation

It has been assumed for the purposes of making adjustments to account for inflation and to bring prices back to 2006 levels that the rate of inflation used in these calculations is close to the rate used in the GDP deflator by DECC for 2010 (2.92%). The value of 3% is used for both 2011 and 2012 returning to 2.5% for 2013 and 2014 and then down to 2% for the rest of the period.

2.2.5 Household Numbers

The historical data provided is based on the Department for Communities and Local Government (DCLG) website reported data (mid-year) adjusted to year end. Regional data has been derived from the figures for UCA's and have been assigned to each LDZ based on a geographical match. There may be some boundary issues with other DN's (SC/NW/EM) but the figures are as accurate as the level of detail provided allows.

Forecasts are based on spot year forecasts from the DCLG website, with the missing years filled in by assuming pro-rata growth between the years. The official 2009 and 2010 data is not available so these years are forecasts not actuals. It should be noted that some areas of the country show high growth in

[3] GDHI is at 2006 prices

numbers in the short term and these may be overstated. This appears to be the case for both LDZ's as household growth to 2013 and beyond seems to be higher than historical rates.

2.2.6 Employment

After a steady rise in employment for nearly 20 years there has been a quite steep decline in the number of workforce jobs between 2007 and 2009, however the latest figures for 2010 show that there was a very small increase in the numbers (20,000 jobs). This pattern is mirrored in the Commercial/Services sector with a larger number of jobs created compared to the total increase (50,000 jobs). Manufacturing has seen a steady decline since 1998 after a period of small growth from 1992 to 1998. The figures for 2010 show a continued decline in this sector, with around 60,000 jobs lost, almost the same number as created in the Commercial/Services sector.

Regarding the future employment levels in the Commercial/Service sector it is expected that there will be a small increase in 2011 as a result of the expansion of the private sector, but that the losses in the public sector will start to bite at the end of 2011 and into 2012. Post 2012 it is expected that employment will grow at a rate in line with historical growth prior to the recession.

Regarding future employment levels in Manufacturing it is expected that there will be recovery in the manufacturing sector briefly as the current Manufacturing Index indicates with a 50% overall recovery for 2011. However this is not expected to continue and the trend is downwards to 2021 at the historical rate of decline.

3. Gas Prices

3.1. General Background

All prices in all markets have shown significant rises from 2002 for households and effectively from 1999 in the non-domestic market. This has been driven by the wholesale gas price rises, which has in turn been driven by rising oil prices. There is expected to be some shocks to oil price given the current crisis in Libya but there are commentators that suggest that the link to oil is being decoupled. There is still limited evidence of that at the moment. Last year gas prices did fall on the back of a falling oil price and prices are expected to rise again during 2011 as a result of the recent high oil prices.

All historical fuel prices used in the development of the retail price indices forecasts are obtained from the Department for Energy and Climate Change (DECC).

2.2.7 Wholesale Price

There has been some significant fluctuation in the wholesale gas price (as represented by the UK NBP price) over time but the general trend has been upwards. The forecast provided to 2014 is based on an average forward price as published by ICIS Heren. Forecasts beyond 2014 are escalated on the basis of the long term trend for average NBP prices.

2.2.8 Retail Price – Domestic

There has been a steady rise in the real price of domestic gas prices although there has been some significant fluctuation as a result of the impact of the wholesale price variation which has an impact on a proportion of the costs incurred by domestic suppliers. It has been announced that there will be a 5% average increase in domestic gas prices by the major suppliers and therefore this price rise is assumed to have an effect on average prices over the last 3 quarters of 2011 and carry over into the first quarter of 2012. This rise will be adjusted for inflation using the assumptions described above.

Ongoing current price rises are anticipated to reflect the rise in wholesale prices and a premium of 1% is added to the current price in the short term to accommodate the development of smart grids and smart metering as some costs are passed on to customers initially.

The index provided is a real price index.

2.2.9 Retail Price – Industrial

There has been a steady rise in the real price of industrial gas prices for many years but with significant fluctuations in line with the fluctuation in wholesale prices. This fluctuation is particularly felt by those customers with large annual consumption as the wholesale price will be a much greater proportion of their charges from their supplier.

Ongoing current price rises are anticipated at this level in line with the trend in rising wholesale prices and a premium of 0.5% is added to the current price in the short term to accommodate the development of smart grids and smart metering as some costs are passed on to customers initially. The lower premium level is anticipated as non-domestic customers will see greater benefits from this technology compared to domestic customers and hence be early adopters or already have some form of smart metering already.

The index provided is a real price index.

4. Efficiency Improvements and Renewables

4.1. Efficiency

As a general observation it has been noted that gas demand has been declining in recent years, but it is difficult to separate the impact of efficiency improvements from the impact of variations in gas prices and the effects of variations in the number of supply points.

It is a fact that there has been a steady and substantial programme of gas fired domestic boiler replacement for several years now and the high levels of efficiency achieved with these new boilers is a possible contributory factor in the decline in gas demand. However the increases in efficiency could have been used to provide higher comfort levels, especially in winter.

The DECC pathways analysis has much commentary on different types of insulation and anticipates high levels of take up of previously underutilised insulation categories e.g. solid wall insulation. It is expected that cavity wall and loft insulation (being relatively cheap) will be increased to the point of saturation in a relatively short space of time but solid wall insulation requires substantial investment and disruption to install and doesn't currently provide an economic solution to those households that pay their own energy bills and could benefit from savings made.

2.2.10 Energy Bill 2011

There are a range of provisions in the Bill to encourage energy efficiency and to remove barriers to investment in energy efficiency.

Green Deal

This is intended to create a new financing framework to enable the provision of fixed improvements to the energy efficiency of households and non-domestic properties, funded by a charge on energy bills that avoids the need for consumers to pay upfront costs. This framework will include:

- powers to set parameters around the use of this facility to ensure consumer protection for both the originator of the work and subsequent occupiers;
- powers to limit access to the financial mechanism in the framework to the installation of measures that are expected to deliver savings exceeding the level of the charge; and
- obligations on energy companies to administer the charges and pass monies to the appropriate party.

Energy suppliers will be exempt from the Consumer Credit Act requirement to gain a credit licence when they collect Green Deal payments. Green Deal Providers will also be exempt from the requirement to hold a consumer credit licence in respect of Green Deal Finance offered to smaller businesses, to avoid segmenting the non-domestic market.

Private Rented Sector

Powers will be established for the Secretary of State, which would, in the event of continued poor energy efficiency performance in the Private Rented Sector, prevent private residential landlords from refusing a tenants' reasonable request for energy efficiency improvements to be undertaken in their properties, where a finance package is available. It would also require private landlords in the domestic and non-domestic sector to improve some of the least energy efficient properties where finance is available. The earliest date regulations could be made is April 2015.

Energy Company Obligation

Existing powers in the Gas Act 1986, Electricity Act 1989 and the Utilities Act 2000 will be amended to enable the Secretary of State to create a new Energy Company Obligation to take over from the existing obligations to reduce carbon emissions (the Carbon Emissions Reduction Target (CERT) and Community Energy Saving Programme (CESP)), which expire at the end of 2012, and to work alongside the Green Deal finance offer by targeting appropriate measures at those households which are likely to need additional support, in particular those containing vulnerable people on low incomes and those in hard to treat housing.

Further measures to improve energy efficiency

Some additional provisions include:

- Amendment of the smart meters powers in the Energy Act 2008 to allow Government to direct the approach to the roll-out of Smart Meters until 2018 and to enable the Secretary of State to make changes to transmission licences to ensure the effective introduction of the new central communications arrangements to support all Smart Meters
- Amendment of the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007, to enable the removal of unnecessary restrictions on access to data
- Establish powers for the Secretary of State to require energy companies to provide information on the cheapest tariff on energy bills

As high level principles the provisions cannot be seen as providing the only solution to cut carbon emissions to the target levels. Relatively low cost measures to improve efficiency like boiler replacement and cavity wall and loft insulation will clearly benefit from the Green Deal proposals, but higher cost solutions like renewable heat or solid wall insulation would need to allow protracted payback periods (approaching 50 years or more) to be viable.

In summary it would appear that there are still significant barriers to major investment in efficiency savings, despite the government’s actions, but the key driver will always be the price of gas when compared to the cost of installing new energy efficient appliances or means of reducing heat loss from premises.

It is we believe unnecessary to predict the level of efficiency savings from different options if NGN have established a clear econometric relationship between gas price and energy demand. The added complexity of forecasting the uptake of certain efficiency measures by type and then modelling the impact that this could have on demand would require significant scenario development, given the range of efficiency measures available, pace of adoption and the wide range of costs of installation. In addition there could very likely be the need to predict changing consumer behaviour, reflecting the comfort levels that people are prepared to accept. The DECC Pathways has much in it about how energy savings can be made by having lower comfort levels, but would this behaviour be different in severe weather conditions, which are the conditions that are of greatest interest to NGN when designing the network.

2.2.11 Smart Meters

On the subject of Smart Metering and information provision to customers it has been observed by Ofgem in their last report (December 2010) that there is evidence to suggest that smart meters can be a vehicle for effective action to reduce domestic energy demand. However there is no distinction between gas and electricity meters and this will not be provided until their final report which was due at the end of March 2011. This is also expected to provide information on seasonal variations. We suggest that any realistic assessment of the impact of smart meters should involve the comparison of weather corrected demand for periods throughout the year of a large sample of smart meter data. Ofgem have suggested that this data will be made available.

We would suggest that until hard evidence is obtained of specific efficiency improvements derived from smart metering that no changes are made.

2.2.12 Carbon Neutral Housing

The previous Government policy on carbon neutral new housing, or sometimes called "zero carbon" housing, has been interpreted by some as being taken literally from the headline title. But in fact the actual policy makes it clear that although carbon neutral is an objective for new housing, the proposed standards published in November 2009 are aimed at reducing energy consumption as much as possible and using where possible renewable sources. Given that this will come into force in 2016 and that gas consumption has already fallen significantly amongst the much larger existing housing market, it should not be necessary to make any specific adjustments to forecasts of household demand, but to keep this area under review for future forecasts.

4.2. Renewables

The government have just announced that there will be a Renewable Heat Incentive Scheme (RHI)[4]. This is considered as a primary source of information for this study. The RHI is aimed at helping to accelerate deployment of renewable heat sources by providing a financial incentive to install renewable heating in place of fossil fuels. Initially, in the first phase, long-term tariff support will be targeted at the big emitters in the non-domestic sector. This sector, which covers everything from large-scale industrial heating to small business and community heating projects, is anticipated to provide the vast majority of the renewable heat needed to meet the targets and represents the most cost-effective way of increasing the level of renewable heat.

As part of the first phase, the Government will also introduce Renewable Heat Premium Payments for the domestic sector. They have ring-fenced funding of around £15 million, which they will use to make premium payments to households who install renewable heating. They may consider focusing support for primary heating systems, such as heat pumps and biomass boilers, on households off the gas grid, where fossil fuels like heating oil are both more expensive and have higher carbon content. They aim to launch the Renewable Heat Premium Payments in July 2011 and will announce further details in May 2011.

A second phase of RHI support including long-term tariff support for the domestic sector will then be introduced in 2012 to coincide with the introduction of the Green Deal for Homes. People in receipt of the Renewable Heat Premium Payments will be able to receive long term RHI tariff support once these tariffs are introduced as will anybody who has installed an eligible installation since 15th July 2009.

In the second phase, they will also consider introducing support for a number of other technologies and fuels which are not supported from the outset.

The key aspects of the RHI tariffs from 2011 for the non-domestic sectors will be:

- Support for a range of technologies and fuel uses including solid and gaseous biomass, solar thermal, ground and water source heat-pumps, on-site biogas, deep geothermal, energy from waste and injection of biomethane into the grid;
- Support for all non-domestic sectors;

[4] DECC Renewable Heat Incentive – March 2011

- RHI payments to be claimed by, and paid to, the owner of the heat installation or the producer of biomethane;
- Payments will be made quarterly over a 20 year period;
- Tariff levels have been calculated to bridge the financial gap between the cost of conventional and renewable heat systems, with additional compensation for certain technologies for an element of the non-financial cost;
- Heat output to be metered and the support calculated from the amount of eligible heat, multiplied by the tariff level;
- Biomass installations of 1 MWh capacity and above will be required to report quarterly on the sustainability of their biomass feedstock for combustion and where they are used to produce biogas;
- The Gas and Electricity Market Authority (Ofgem) will administer the RHI including: dealing with applications; accrediting installations; making incentive payments to recipients; and monitoring compliance with the rules and conditions of the scheme; and
- The RHI will be funded from general Government spending, not through the previously proposed RHI levy.

From 2012, the Government plans to introduce a second phase of support, which will include RHI tariffs for domestic installations and a number of additional technologies and fuel uses. Of particular note is that air source heat pumps are excluded from the initial support arrangements until there is a better understanding of the costs associated with these installations. These installations will be eligible for the Renewable Heat Premium Payment. Conversions of existing installations are excluded at the moment.

HMG will only provide incentives for technologies which are already in commercial use in the UK.

HMG is committed to providing 12% of heat from all renewable sources. The total figure quoted by them is 73 TWh, a reduction of 15 TWh from the original target of 88 TWh.

For further information on Renewables please see section 6.2.

5. Scenarios

The high and low scenarios that have been developed for this study are based on the following assumptions.

5.1. GVA for GB, NE & NO

High – GVA will grow over the next two years to become equivalent to the highest rate of growth in recent history (since 1989). An exception has had to be made for Manufacturing and Industrial as this would give extreme scenarios. The average rate of growth for years of growth has been used.

Low – GVA will not grow at a rate higher than last year’s rate. An exception has had to be made for Manufacturing and Industrial as this would give an extreme scenario. The average rate of decline for years of decline has been used.

5.2. Wholesale Gas Price

High – The linkage to oil prices is retained and there is increased pressure on the oil market driven by increased demand in India and China and other developing markets, exacerbated by further unrest in the Middle East. This will drive oil prices over $200 per barrel by the end of 2012 and wholesale gas prices to 2.35p per kWh. Following this period there will be sustained high prices rising by the historic escalation rate, but no recovery to historic levels due to price creep and pressure from governments to encourage efficiency and reduced fossil fuel usage.

Low – It is assumed that the price becomes completely de-linked from oil prices and that the low growth/declining growth in UK gas demand forecast by many commentators results in a steady decline in price escalation to a zero rate of growth in current terms by 2015 and hence a negative rate of growth in real terms. This assumes that there will be significant progress by this time towards the UKG 2020 targets related to renewable heat and that some of this will be replacing some gas consumption from large industrial consumers.

5.3. Retail Gas Price

The scenarios presented reflect the impact of the wholesale price scenarios directly on the retail price as a cost pass through.

5.4. GDHI

High – GDHI will grow over the next two years to become equivalent to the highest rate of growth in recent history (since 1989).

Low – GDHI will not grow at a rate higher than last year's rate. There is an exception for NO LDZ as last year's rate was unusually high so the rate for 2008 was used.

5.5. Household Numbers

High – The figures quoted by the Department for Communities and Local Government (DCLG) website show forecast growth rates above the historical highest rates in absolute number terms, but not in percentage terms. It is therefore suggested that the high growth case should reflect the highest percentage growth rate in recent times (since 1987).

Low – This should reflect the lowest percentage growth rates since 1987.

6. Annual/Peak Relationship

6.1. 1 in 20 Peak Methodology

There has been some discussion in the industry mainly within the Demand Estimation Sub-Committee (DESC) regarding the relationship between demand and the weather and there have been changes to the basis for establishing the Seasonal Normal Composite Weather Variable (SNCWV). However there has not been much attention paid to the relationship between annuals and peaks and the historical basis for developing the 1 in 20 peak day remains the methodology currently in use by many forecasters.

TPA Solutions has some concerns that the drive by DESC to amend the SNCWV basis could be introducing potential errors in the calculation of the 1 in 20 peak day and also errors in weather correction when there are large differences between actual weather and seasonal normal. Errors in weather correction are primarily important when developing an annual forecast as the weather corrected values give the historical seasonal normal demands that form the basis of the assessment of any growth or decline in demand for annual demand forecasting models, but they can also be an issue should there actually be 1 in 20 weather as it may give a false indication of the observed 1 in 20 peak day.

TPA Solutions has in recent years been using the traditional methodology for calculating the 1 in 20 peak day and have seen some evidence of some small changes in the behaviour of customers in severe weather which suggests that there may be a need to review the methodology. There is clear evidence that average consumption per customer (especially in the domestic sector) has been falling, driven by rising gas prices, which has been encouraging the replacement of inefficient gas boilers and installation of cheaper forms of insulation. But it is also possible that customers are trying to conserve energy by turning thermostats down when heating is on. However it is not clear if the customer, when it is very cold, would maintain that strategy.

Another area of interest is the different behaviour patterns during extreme weather where there is the presence of significant quantities of precipitation (primarily snow). This has the effect of changing gas demand, typically reducing larger NDM and DM demand and in some circumstances increasing to a degree small NDM demand. This is however a transient effect in long periods of cold weather as businesses, schools etc. get back to normal operation (although the evidence last winter suggests this takes some time in some areas).

The question that has to be asked is should these effects be incorporated into the assessment of peak?

When looking at any changes to the annual/peak relationship the evidence has to be gathered in order to provide a basis for changing a long established methodology. It is not our intention in this report to provide a complete review of the actually methodology to determine 1 in 20 peak day but to recommend that consideration is given by NGN to these issues in developing a 1 in 20 peak day forecast and where possible to gather evidence of changing behaviour. It is therefore recommended that when calculating the 1 in 20 peak day a full analysis is carried out on the resultant load factors for each relevant load band to establish if there is a noticeable trend from year to year. If this can be identified then this can be incorporated into any long term forecast of 1 in 20 peak day.

It is also recommended that the impact of precipitation, particularly snow should be considered when reviewing the formula used to calculate the Composite Weather Variable (CWV) as this factor may be affecting the accuracy of weather correction and the weather demand models. Alternatively consideration should be given to reviewing the cold weather upturn element of the CWV.

2.2.13 Climate Change

Climate change has historically been assumed to have no effect on the methodology for the 1 in 20 peak day, as there is no evidence at present that the weather is any less severe. This should be kept under review but for the time being it is essential to ensure that the use of the new SNCWV basis does not unduly influence the calculation of peak.

2.2.14 Use of Smart Meter data

It has been suggested in some forums that smart meter data could be used to validate the peak forecast. This assumes that access to smart meter data is provided. It is something that should not be dismissed but that should be approached with caution. From the very outset the methodology for relating annuals to peaks and the development of the weather demand models is based on a high level approach using primarily aggregated LDZ level demand and weather data. It therefore gives an overall high level assessment of the relationship between weather and demand across a load band, which by the very nature of this approach means that any analysis done at the individual customer level, will not give the same results as the high level analysis, especially in the domestic market given the large numbers and variety of customers in that category. The issue of diversity is also important and would have to be assessed if large numbers of

If there were sufficient numbers of customers then it could be possible to use this sample in aggregate to perform some form of validation, but the effort required should not be underestimated as there will be the need to perform significant cleaning and manipulation of the data for it to be usable. The issue of the level of diversity involved is also important and would have to be assessed.

The sample has to be representative of the load band and as there is typically only one weather station being used per LDZ the data must be spread across the whole LDZ. Having information on location may pose some data protection problems, but it should be possible to avoid this by using post code data, if this is available.

It should also be considered that consumer behaviour could be influenced by the presence of a smart meter so any results could be biased by this until everyone has a smart meter, which on current targets could not be until 2020, if everything goes to plan.

It is important to use actual indications of changed behaviour rather than expected changes in behaviour in this respect to avoid the risk of under or over estimating demand during peak periods.

2.2.15 Alternative approaches

Some alternative approaches that have been examined to develop the annual and peak relationship are listed below with comments on their viability.

- Use an historic annual/peak relationship that existed prior to significant improvements in efficiency. This approach can be described as covering the circumstances where customer behaviour in severe weather is completely independent of behaviour under most other conditions. This is particularly applicable to households. There may be some conservation of energy taking place during most winters but in the severest of winters it could be assumed that the typical customer would rather keep warm than save money. Ways that this type of behaviour could be reflected in the forecasts are as follows:
    - An additional explicit allowance for random error could be incorporated into the weather demand model but this could possibly be seen as being outside the principles of the 1 in 20 peak methodology as specified in the UNC

    - Take the relationship between customer numbers and peak, prior to the substantial decline in average consumption experienced recently and apply that relationship to a forecast of customer numbers. This again may not be consistent with the UNC methodology but could be tested as a scenario. It is also possible that this could overstate the peak day requirement and may also be less auditable than the current methodology
- Use different periods of historical data when developing the weather demand models for each load band. It is possible to justify use of winter 6 months only and whole year data for different load bands given the widely varying profiles of demand in the different bands. This could give quite widely variable load factors, but introduces an element of judgement to select the most appropriate value. The differences are most notable in the DM load bands
- For certain large loads use the SOQ instead of the peak derived using the load factor for the load band. This would require some assessment of diversity with these loads otherwise there is a risk of overstating the peak
- Develop a supplementary commercial model which models the behaviour of suppliers and their customers in cold/severe weather with respect to load management. This has been done in the past by NG NTS, but caution should be used when doing this as there is still a commitment to provide peak capacity if it is booked by the shipper and hence there is a risk that the peak could be understated

6.2. Impact of Renewables

TPA Solutions have thoroughly analysed the impact of renewable energy sources on both annual and peak demand and can provide a range of possible outcomes depending on the level and phasing of take up by consumers and the energy source that the renewable source is replacing. The focus has been on renewable heat sources for this analysis. Specific adjustments can be made to the annual and peak forecasts to take account of renewable energy and could result in changes to the annual/peak relationship over time.

Factors that have been considered in developing the potential impact of renewable energy include:

- The payback period for different types and the likelihood that subsidies or renewable heat incentives will be available or that the Green Deal will provide sufficient support to justify installation
- Restrictions in using biomass in many locations due to the Clear Air Act
- Any circumstances where gas will still be needed as a back up to support renewable sources that cannot guarantee supply in winter, or are too expensive to run in winter (e.g. solar, wind and air and ground source heat pumps)
- Assumed that oil and coal users will be the target for early adoption on the basis that these are the most polluting, followed by either gas or current electricity users depending on what the objective becomes. If it’s purely environmental then gas should be first, but the economics without subsidy favour gas over electricity

Biogas is excluded from any impact analysis on the grounds that if it is to be distributed locally to maximise its use, then the current network is the most efficient way to do this. So there will be the same level of demand, but a different source. This may require local reinforcement to achieve.

The following sections describe the different sources of renewable energy and how they could influence the demand for gas and affect the relationship between annual and peak gas demand.

6.2.1. Biomass Heat

This is defined as burning any form of biological matter that can be used in a boiler to generate heat. The target published by the previous government was set at 42.9 TWh on an input basis and 38 TWh on an output basis.

The UK Renewable Energy Strategy under the previous government stipulated that if small scale biomass heat plant is used to meet the renewable target, to minimise the impact on air quality they should replace existing solid fuel (primarily oil and coal) fired plant, and be located off the gas grid, or away from populated areas.

The RHI has within its Impact Assessment (IA) a figure of 28 TWh as an assumed impact of the RHI tariff on new biomass schemes, but this is primarily rural (70%).

Large scale plant is likely to be associated with district heating schemes or I&C consumers and only then in areas where air quality will not be affected, although the RHI Impact Assessment (RA) includes some costs for dealing with air quality issues. There is some discussion about this in the RHI report and there will be emissions limits imposed on biomass plant.

It should be assumed that some gas demand will be lost to biomass heat, affecting both throughput and peak. However it should also be assumed that there should be very limited impact on domestic demand because of the constraints and lack of incentive for current gas customers. Also the current RHI is targeted at non-domestic customers and domestic customers may be part of the second phase.

It is conceivable that some biomass operators may seek a gas supply as back-up in winter due to the fact that under severe conditions, stocks of biomass fuel will not be available, either because of excessive demand, insufficient storage space to stock up for severe conditions, or weather conditions that prevent supplies getting through. There may also be opportunities for dual-fuel applications mixing natural gas with biomass. The availability of suitable feedstock is mentioned in the RHI report and installations over 1 MWth are required to report on availability of feedstock on a quarterly basis.

Replacing a natural gas boiler with a wood burning boiler currently results in higher energy costs and higher CO_2 emissions.[5] Savings against solid fuel or electricity only amount to between £170 and £390 per annum. An automatic feed domestic installation costs £11,500. Manual feed systems are much cheaper at £4,000.

6.2.2. Biogas Heat

This is essentially gas produced from biological matter and used to produce heat. The intention is that this gas will be delivered into the current gas network as biomethane, or used locally to the source. Although the Government are committed to ensuring that all new homes are low carbon by 2016, which could

[5] Energy Savings Trust (EST) website figures

constrain the use of biogas primarily to existing homes. The RHI will be supporting the direct production of heat for installations up to 200kWth and biomethane injection of all capacities through a single biomethane injection tariff.

The quality issues are such that the gas has to be treated before entry to the network and it is stated in the UKRES that there will be studies to establish what elements of the entry specification can be changed to avoid barriers to entry, providing safety is not compromised.

Although some of the local usage may lead to loss of some customers connected to the NGN network, it should be assumed that Biogas Heat has no impact on throughput or peak.

6.2.3. Air Source Heat Pumps

Air Source Heat Pumps absorb heat from the outside air, which can then be used to warm water for radiators or underfloor heating or to warm air that is circulated within the property. This can still be done at temperatures as low as -15°C. They consume electricity to operate. Current economics are such that to replace a domestic gas boiler with this technology from the average performing system would not be economic as the running costs are higher for the air source heat pump. Annual savings with a high performing system are around £70 per annum[6]. Installation costs are estimated at £6,000 to £10,000[7]. There are however opportunities under the Green Deal to obtain loans for this investment with the payback of the loan coming from the energy savings. However with such small savings it is not clear that loans will be available for this considering the long payback period.

For this reason it could be assumed that all domestic use of this technology will be to replace non-natural gas heating. There is currently no plan to provide RHI for this technology but it will be reconsidered in phase 2 in 2012.

The economics of larger scale plant used in I&C applications would depend on the installation costs and retail energy prices to this sector. In the worst case it would result in a decline in throughput and some decline in peak depending on the heat output on a very cold day. It is stated by the BSIRA that as temperature falls the level of heat output declines so in cold or severe weather supplementary heating will be required. Again this may result in gas back-up for cold weather. There will be a base load of heat from the heat pump but this will fall as weather gets colder, unless the installation is designed with the extreme condition in mind. This could however mean that the efficiency is so low in cold weather that it would be cheaper to use gas than the electricity used for the heat pump.

6.2.4. Ground Source Heat Pumps

Ground Source Heat Pumps absorb heat from the ground, which can then be used to warm water for radiators or underfloor heating. It can also be used to pre-heat water going to conventional boilers. As the ground temperature is relatively constant the heat flow should be constant throughout the year. They consume electricity to operate.

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[6] EST website figures
[7] EST website figures

Current economics are such that to replace a domestic gas boiler with this technology on an average performing system would result in higher running costs and for a good performing system the saving is £70 per year. Installation costs are estimated at £9,000 to £17,000. Similar issues arise with Green Deal funding as for Air Source Heat Pumps. RHI will initially be available for non-domestic installations with a Coefficient of Performance (COP) of greater than 2.9. For these reasons it could be assumed that all domestic use of this technology will be to replace non-natural gas heating.

Large scale plant will have similar issues to the air source heat pump but the constant heat input of ground source heat pumps leads to lower back-up requirements in winter compared to air source heat pumps.

6.2.5. Solar Heat

The principle here is that solar panels are used to heat water and this water is used to support the current heating system.

Current economics are such that the energy savings made for domestic customers are very small (£50 per annum[8]) which would typically make the £4,000 investment cost uneconomic. Similar issues arise with Green Deal funding as for Air Source Heat Pumps. The existing Renewables Obligation and Feed-in Tariffs schemes have encouraged some energy suppliers to increase their renewable electricity generation. This has resulted in some expansion in wind-farms and funding of domestic solar panels for the best sites (predominantly south facing locations).

However it would be unwise to assume that peaks will also decline due to the reduction in heat output on days of low sunlight hours, which occur in winter when the heat will be needed the most.

It is therefore most likely that there should be an adjustment to annual demand to reflect the reduction in gas demand but no adjustment to peak as there is no guarantee that solar heat would be available on a peak day.

6.2.6. Scenario options

The following is a list of possible scenarios that can be developed to test a range of assumptions with regard to the take up of various renewable heat sources in competition with carbon based fuels. These scenarios also include different assessments of the impact on annual and peak demand which can be incorporated into the different forecasts, reflecting an assessment of the changing relationship between annual and peak demand.

1. The full renewable target set by the government is met and energy produced by all the renewable heat sources results in a full loss of gas consumption equivalent to NGN’s share of the total renewable heat produced

2. The full renewable target set by the government is met and energy produced by all the renewable heat sources results in a loss of gas consumption equivalent to 68.8% of the total renewable heat produced (current penetration of gas into the heating market)

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[8] EST website figures

3. The full renewable target set by the government is met and energy produced by all the renewable heat sources results in a loss of gas consumption equivalent to 53% of the total renewable heat produced

   This scenario is based on scenario 2 but includes the following revised assumptions

   - Gas will contribute its fair share to the renewable target, but the reduction in demand from biogas in scenario 2, equivalent to 10% of the full target, is not included because the gas will be transported by the gas networks
   - Biomass will not be used in households currently using gas as a result of air quality issues, equivalent to a reduction of 6% of the full target. Up to 70% of the non-domestic reduction is expected to be rural and therefore this could be assumed to replace solid fuel. However the maximum available alternative fuel reduction from gas in this category is insufficient to meet this objective, so it has to be assumed simply that biomass will not be used in domestic applications but could be used in non-domestic.
   - It is assumed that there will be minimal impact on peak demand based on the assumption that any of the alternative energy sources cannot deliver sufficient energy to meet a 1 in 20 peak day requirement

4. An alternative scenario can be used which assumes that the renewable contribution to peak will be 50% of the maximum that would occur by applying the average load factor to the annual reduction in demand under scenario 3

5. 50% of the full renewable target set by the government is met and energy produced by all heat sources results in a loss of gas consumption equivalent to 50% of the total renewable heat that would be produced to meet the full target

6. 50% of the full renewable target set by the government is met and energy produced by all the renewable heat sources results in a loss of gas consumption equivalent to 34% of the total renewable heat that would be produced to meet the full target

7. 50% of the full renewable target set by the government is met and energy produced by all the renewable heat sources results in a loss of gas consumption equivalent to 26% of the total renewable heat that would be produced to meet the full target

   This scenario includes the following revised assumptions

   - Gas will contribute its fair share to the renewable target, but the reduction in demand from biogas in scenario 5, equivalent to 5% of the full target, is not included because the gas will be transported by the gas networks
   - Biomass will not be used in households currently using gas as a result of air quality issues and therefore the assumed reduction in household demand from this source is not included. This is equivalent to 3% of the full target

- It is assumed that there will be minimal impact on peak demand based on the assumption that any of the alternative energy sources cannot deliver sufficient energy to meet a 1 in 20 peak day requirement

8. An alternative scenario can be developed which assumes that the renewable contribution to peak will be 50% of the maximum that would occur by applying the average load factor to the annual reduction in demand under scenario 7
9. A further alternative scenario which is the same as the above but it assumes that priority will be given to reducing oil & coal before gas

6.2.7. Qualitative comments on scenarios

As a general observation it is more probable that the targets will not be met than will be met, but as to what the percentage will be it is difficult to say. The level of ramping up required to achieve the 2020 target is very severe and will require a fundamental change in consumer behaviour and significant investment by the consumer or by government through incentive mechanisms which are currently being rolled out.

One study carried out for DECC (Enviros Consulting – September 2008 – Barriers to Renewable Heat Part 2: Demand Side) identifying the barriers to renewable technology show that there are many barriers classified as high (over 50% of all the barriers across all the renewable technologies). This same study acknowledged that "lack of interest" was an important factor but did not address it because it was mainly a domestic issue and there was sufficient untapped interest in the non-domestic sector and with some domestic customers. They therefore considered it was not a high priority to address this as the major barrier was cost. However modelling carried out by another consultant referred to in the Enviros Report (Element Energy - TNS UK, 2007, The growth potential of microgeneration. Report on qualitative research) suggests that opportunities for renewable heat are greater in the domestic sector.

Scenarios 1 and 5 are the least likely to occur given that it is certain that all current alternative energy sources for heat are more polluting or more costly than gas, hence they should be the sources that are going to be replaced first.

Scenarios 2 and 6 are probable scenarios but less likely than scenarios 3 and 7 as it is clear from government documents that the adoption of biomass in household situations will not occur in most circumstances because of clean air restrictions. Also biogas is very likely to be delivered using existing gas networks and therefore will have no impact on the demand for gas from the networks and may as a worse case require investment to accommodate the flows from biogas plant.

Scenarios 3 and 7 from the point of view of annual gas are equal to 4 and 8. However from a peak perspective it is very difficult to say at the moment without any detailed evidence of the impact that current renewable sources have on consumer behaviour at peak. What is known currently is that there will be a need to supplement renewable energy sources on a peak day with a very flexible source of instantaneous energy, unless:

- The renewable sources are oversized significantly to cope
- More than one renewable source is installed that is unaffected by the particular conditions that impact the primary source
- Consumers are prepared to be colder than they would normally be
- Widespread district heating is adopted which can accommodate fuel storage/alternative heating options

With regard to scenario 9 the probability of this occurring will be linked to various mechanisms that the government are developing to encourage renewables. The actual level of reduction will be determined by consumer take-up from those that want to use the new technology because of personal preference as it is clear that the government wants to get some quick early impacts on reducing emissions and therefore are encouraging the biggest polluters to adopt renewable technology first.

7. Application of Analysis to 2050

7.1. Introduction

The application of the economic variables included in this report and the translation of the assessments of energy efficiency and the annual/peak relationship to a period long into the future is extremely speculative. A starting point for this could be the Redpoint study or alternatively we could equally use the DECC Pathways analysis which has multiple scenarios any of which could be feasible, given a certain behavioural change by consumers and depending on the amount of money that the consumer or other parties is prepared to spend on changing behaviour.

7.1.1. Redpoint Analysis

The Redpoint analysis commissioned by the Energy Networks Association draws heavily on the DECC Pathways analysis. Its conclusions are that gas does have a major role to play to 2050 but this is quite heavily caveated by the need for some major developments. These include:

- Successful roll-out of Carbon Capture Storage technology
- Biomethane injection into the distribution networks
- Roll-out of district heating systems
- Development of dual fuel domestic systems that can use gas and/or electricity

The study does highlight the fact that there are significant cost advantages of using gas compared to more electrification (£20,000 per household on an NPV basis). A high gas future also has advantages as other options rely heavily on new technology which will pose a range of risks to the delivery of a low carbon future compared to established technology associated with gas.

Gas networks are also stated as being cheaper to maintain than other options associated with a transition to a low-carbon future.

Four scenarios were developed by Redpoint which are summarised below.

- Green Gas – low prices (due to development of unconventional gas), CCS development, biomethane injection and use in CHP for district heating (some with CCS), duel fuel in domestic with gas providing the peak, some CNG
- Storage Solution – mainly gas at transmission level, low prices (due to development of unconventional gas), CCS development, gas key source of low carbon power generation, electricity and heat storage development resulting in steep decline in gas via distribution system (2/3rds decommissioned)

- Gas Versatility – No CCS so transmission gas for generation very low by 2050, heat/electricity storage not developed so gas retains balancing role and major source for heat, some CNG, maximise biomethane injection to reduce overall emissions from gas used in heating
- Electrical Revolution – gas eliminated over 30 to 40 year period, 2050 all gas networks decommissioned

The most important aspect of this study is that the Green Gas solution is on the surface a lower cost solution, but one which relies on the commercial development of CCS, district heating and large amounts of biogas. Given the recent developments of shale gas in the NW UK and other parts of the world, particularly the US, lower gas prices could be achieved (at least in the short to medium term) which could keep gas at the forefront when comparing with other energy sources, especially renewables that rely on incentives that can be removed at any time, or those that need electricity to operate. There are recent examples of renewable projects being shelved because of the changes to feed-in tariffs.

7.1.2. DECC Pathways

This document contains a detailed analysis of the possible future of different energy sources in different market sectors going out to 2050. For each sector of the economy, four trajectories have been developed, ranging from little or no effort to reduce emissions or save energy (level 1) to extremely ambitious changes that push towards the physical or technical limits of what can be achieved (level 4). The overall target is to reduce greenhouse gas emissions by 80% in 2050.

In the specific area of heating and cooling the technology pathways are detailed under sixteen different scenarios. For natural gas the implications are quite severe to say the least. Of the sixteen scenarios developed there are none with natural gas as a source and ten that contain biogas as a source, where it is acknowledged that this could be transported by the existing network. An essential element of the analysis is the assumptions regarding insulation and hence efficiency improvements.

From the material provided by DECC in the study there are some comments about factors that will affect take up rates of different types of efficiency measures. For example:-

- 28% of owner-occupiers do not take up any measures irrespective of how cost effective they are
- There is no incentive for landlords to spend money on insulation to save on their tenants energy bills – other than a £1500 tax allowance for them on each property where they install "solid wall insulation" for example – the latest Energy Bill does try to address this issue
- People are put off by floor and internal solid wall insulation because of the disruption and loss of floor space from the wall insulation
- Greater efficiency encourages "comfort taking" such that energy efficiency supports higher internal temperatures

There has been a theme running through many of the studies on renewable and efficiency improvements that will not go away, that is customer inertia.

7.2. 2050 Viewpoint

It would be appropriate to examine the different elements included in the earlier sections of this report to establish if it would be relevant to extend the model to 2050 or not and if so how this could be achieved.

7.2.1. Economic Assumptions

Any model that attempts to forecast the state of the economy beyond the very near future however good the model can't anticipate everything that could happen in the next 40 years. There are economic cycles that can be replicated but the further out that the forecast goes, the more scenarios that are needed to encompass the range of possibilities. Furthermore, the relationship that is developed between gas demand and for example the economy, could become less reliable as a predictor of gas demand as greater influences take over, for example the extent of renewable heat that replaces gas, or the improvements in insulation and energy efficiency.

Taking that uncertainty down to a regional level has the potential to create even greater uncertainty as the interpretation of the impact of specific national assumptions on each region could introduce another possibility for error in the forecast. The traditional way to address this is to use more scenarios.

7.2.2. Gas Prices

The same can be said about gas prices as can be said about economic assumptions, but for quite different reasons. Creation of a forecast of gas prices way into the future will require the impact of more possible variables than currently used. In addition to oil price and the linking or decoupling of gas from oil price, there will be the effect that the penetration of renewable heat has on the dynamics of gas pricing. There could be a shift to link gas prices to renewable heat prices in some sectors of the market where they are directly competing with each other. The ability of gas to compete with renewable heat sources will be dependent on how long the government is prepared to support the development of renewable sources when they become established.

It is anticipated currently that renewable heat that relies on the weather to deliver will be somewhat variable and unless there is a reliable and cost effective means of storing heat (or electricity) there could be an enduring role for gas as a peak shaving fuel. So the overall decline in gas consumption predicted by some as a result of renewable heat, could lead to a declining average price for gas as surplus capacity builds up for a period, especially if it is decoupled from oil, but there could be very high value attributed to gas on high heating demand days.

One important aspect of gas prices that could develop is the comparison with retail electricity prices, particularly in the domestic sector. Renewable heat sources like air and ground source heat pumps use electricity to operate and currently the electricity prices are sufficiently high to make this type of renewable heat uneconomic when compared to high efficiency gas boilers. If it is to be believed that we will become heavily reliant on electricity in the future for our heating purposes, what will happen to the price spread between gas and electricity by 2050. Will it be so big as to turn around the decline in demand for gas despite the best efforts of government to encourage renewables? Does the development of new unconventional gas combined with increasing demand for electricity make matters worse?

Many of the DECC Pathways scenarios have high proportions of air and ground source heat pumps, which would push up demand for electricity substantially. Could the very growth in these types of renewables create a barrier to their use?

7.2.3. Energy Efficiency and Renewables

The DECC Pathways study is a major source of information about the potential for future development of both efficiency measures and renewable technologies. We examine what can be used from this study to inform the debate into the impact on gas demand out to 2050.

7.2.3.1. Energy Efficiency

The DECC Pathways analysis contains a lot of information about potential developments in insulation that could be important to the long term assessment of energy and gas demand out to 2050.

They set out four levels of change that could happen with wide ranging results for the different types of insulation measures.

These four levels are then translated into a graph of annual consumption for the household sector. Two of the four levels lead to an increase in demand. Level 1 rises steeply and level 2 rises steadily.

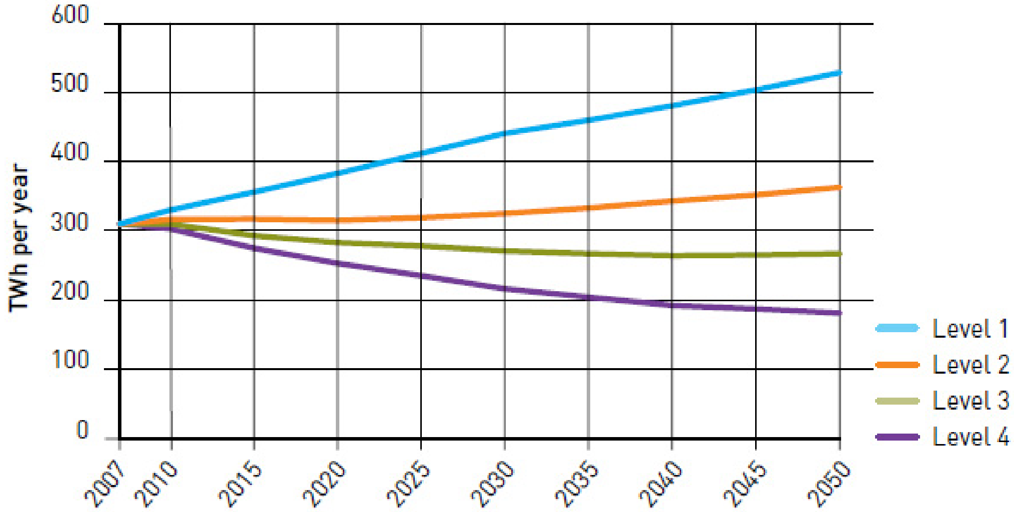
If you look at the data closely you can see that they assume that in 2007 8m premises are suitable for solid wall insulation, 9m for cavity wall insulation, 12m floor insulation, 24m triple glazing, 22m loft insulation and 25m improved air-tightness.

To illustrate how wide the range of assumptions are, solid wall insulation is assumed to be carried out in 400,000 homes by 2011 in level 1 (a 5% success rate) compared to 7.7m homes by 2040 (a 96% success rate) in level 4. It can only be assumed that what they are saying in level 1 is that 400,000 homes will have had solid wall insulation completed in four years. But then nothing happens after that. The number of solid wall insulation installations that were carried out in 2007 is estimated at 34,000 of which 16,000 were new builds. So the rate of installation will have to increase significantly to meet the 400,000 target (up from 34,000 per year to 100,000 per year). The rate of installation for the level 4 target would need to be 230,000 per annum. But there is a slight problem with solid wall insulation. The Energy Savings Trust states that it costs somewhere in the range £5,500 to £14,500 with a saving of £400 per annum which gives a payback period of between 14 and 36 years. There is also the added problem that it can increase the amount of condensation produced and this can lead to a range of problems from mould to structural damage. There are various hidden costs of this type of insulation of between £5,000 to £9,000 for external and £10,000 to £19,000 for internal.

The lowest paybacks are loft and cavity wall insulation with less than 5 years and switching fuel under 10 years. Whole house efficiency measures have a payback of just less than 30 years, whilst to payback in 3 years, a subsidy of between £25,000 to £45,000 would be needed depending on how many different measures are taken. This assumes that everything is done at the same time.

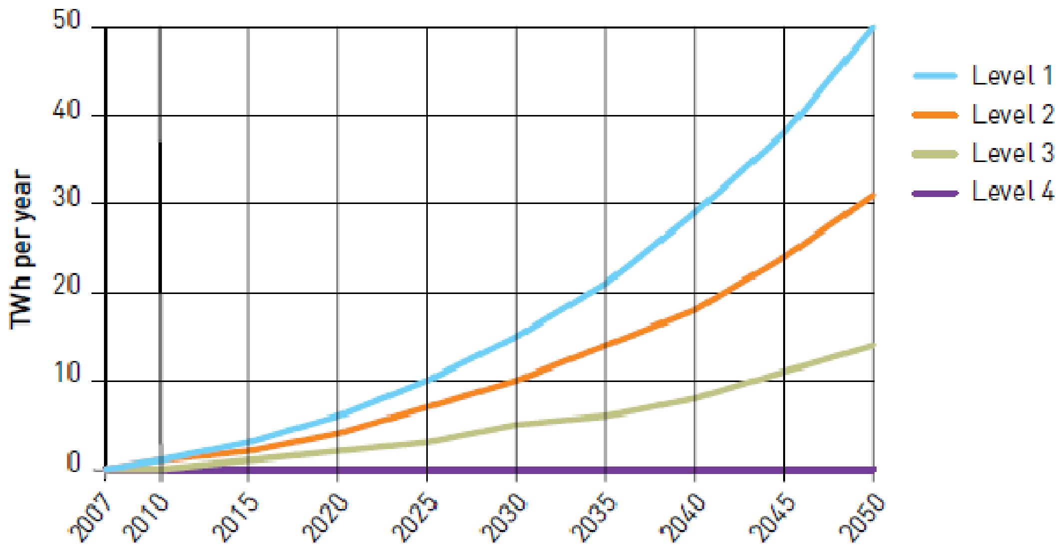
The four trajectories that DECC have used are illustrated in the graph below.

Figure D3: Trajectories for total domestic heat demand under four levels of change



On top of heat demand there is growth in energy consumption for cooling demand in all cases except level 4.

Figure D4: Trajectories for total domestic cooling demand under four levels of change



The same figures for the non-domestic sector are shown below which have a similar outcome.

Figure D5: Trajectories for total non-domestic heat demand under four levels of change

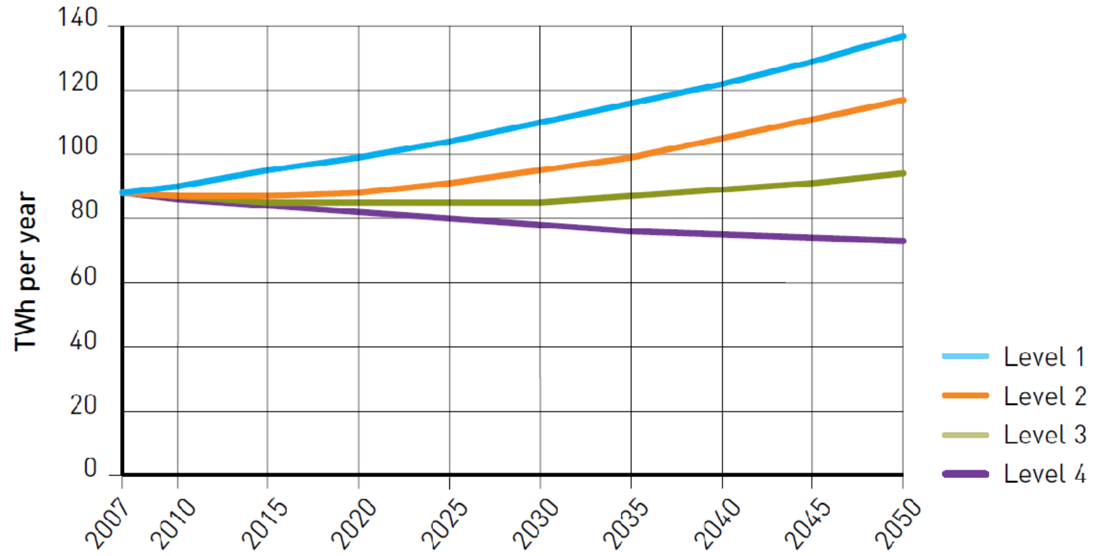
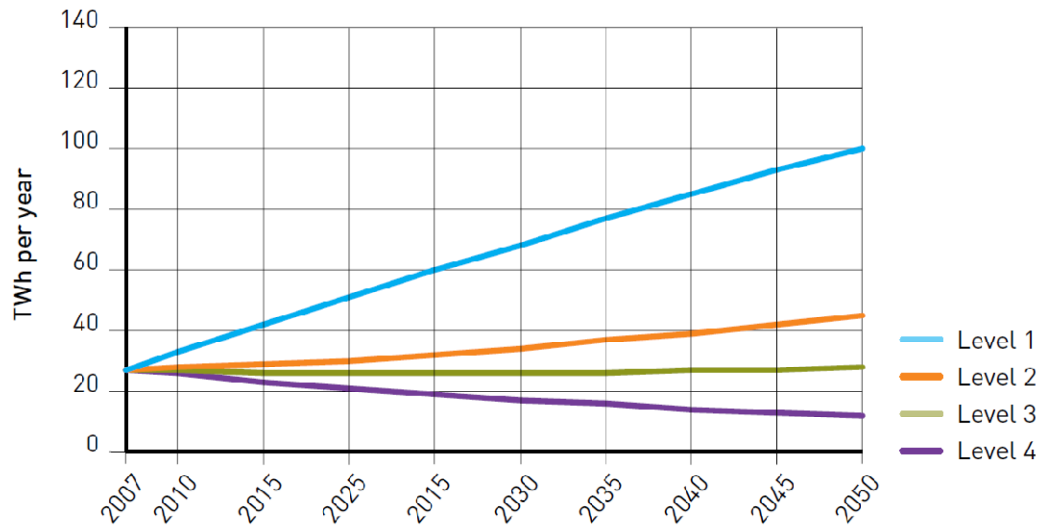


Figure D6: Trajectories for total non-domestic cooling demand under four levels of change



However the greatest impact on NGN demands of the DECC Pathways report is not whether various types of insulation will be installed, but whether there will be any gas demand (other than biogas) in the long term. If we exclude the impact of any growth in renewable heat then the impact of all insulation measures on domestic heating demand between 2007 and 2050 can be assumed to be broadly in the range from zero (as any increase in consumption in the DECC figures is assumed not to be attributed to reducing levels of insulation) and the difference between the level 1 consumption and the level 4 consumption. This equates to 350 TWh. If we assume that 70% of domestic heat is from gas that relates to a range for gas of zero to 245 TWh. The figures for non-domestic heat are zero to

63 TWh (which is zero to around 44 TWh for gas). This would give a total reduction in gas demand due to insulation measures of 290 TWh by 2050.

If we take the mid-point from the DECC data we get a total reduction in demand of 145 TWh by 2050. It would appear that the growth in energy efficiency from insulation is close to a linear relationship (at least in the major domestic market) and therefore it would be appropriate to pro-rate any reductions to obtain the figures for any year up to 2050.

7.2.3.2. Renewable Heat

DECC Pathways has a lot of commentary about the potential for renewable heat sources and in all its sixteen scenarios as stated above natural gas does not feature and only biogas has a role. This could in most cases be transported by the current networks.

The uptake of renewable heat is heavily dependent on consumers seeing more than just environmental benefits. There has to be a significant financial incentive to adopt new technology and to change their reliance on an extremely reliable and on demand service. There does not seem to be evidence to date that there is sufficient incentive to encourage mass adoption, which would be needed to meet the scenarios presented by DECC.

It would seem on balance that the outcome of the Green Gas scenario from Redpoint to be a much more pragmatic approach, rather than an idealistic one that places almost total reliance for the large proportion of heat supply on a combination of a single network (electricity) and the weather.

7.2.4. Annual/Peak Relationship

The most significant aspect of this relationship out to 2050 (assuming gas actually is being supplied) is how base load and peak heat demand will be supplied. The ultimate position that can be conceived is that a combination of renewable sources provides the bulk of heat supplies and gas meets the need of extreme peak demand in severe weather, or when there are unexpected interruptions in heat supply. This poses a substantial dilemma however, how low does the annual demand have to fall before the cost of supplying only peak gas becomes totally uneconomic?

What will be certain is that as renewable sources increase there will be a steady falling trend in the load factor, which could have consequences for the way that gas transportation costs should be recovered and how charges are applied to different types of customers.

7.3. Conclusions

It would appear from the wide ranging information presented in both the Redpoint and DECC reports that there is an unprecedented level of uncertainty in the future of gas demand in Great Britain if you are looking to forecast gas demand out to 2050.

Any forecast of drivers of gas demand will become either increasingly difficult to predict reasonably reliably requiring more scenarios or the drivers themselves change significantly over time. The current forecasts provided to NGN are appropriate for the relatively short period of 10 years but to forecast assumptions to be used out to 2050 would require a quite radical rethink of the methodologies used or include more drivers and more scenarios. With regard to gas prices there will need to be greater attention paid to the interaction with electricity prices should the "electrification" of heating requirements develop.

It does appear that there are clear indications from government that they do not see a future for gas by 2050, but since the publication of the DECC Pathways document there does appear to be some slight softening of that stance and many commentators are saying that we should not dismiss the role of gas in reducing carbon emissions, many of which have no clear vested interest in the future of the gas industry, like Dieter Helm.

The key areas that will take on a much more significant role in the future are energy efficiency and renewable heat. There are some clear indications from DECC of the level of insulation improvements that could be achieved, but in the absence of the highest levels of improvement, greater reductions in carbon based consumption will be required to achieve the 2050 emissions target. The fundamental issue that affects the UK's ability to achieve its target is the upfront cost of installing high quality insulation and renewable technology. This is particularly important to households being the single largest major users of gas for heating currently.

To develop a realistic set of scenarios out to 2050 with regard to the impact of energy efficiency and renewable heat requires very careful scrutiny of the range of possibilities. It is recommended that changes that require the most extreme payback periods (say 40+ years) are not included in any analysis and low probability applied to those with long paybacks (say 20+ years).