

# Medium Term Price Outlook

## Forecasts of Gas and Electricity Prices 2009 - 2015

March 2009

Inenco Group Limited



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# I. EXECUTIVE SUMMARY

In an environment where energy costs have become increasingly volatile and have reached a new level of significance for many organisations, an understanding of the future movement of energy prices has become increasingly important. This report sets out an analysis conducted by Inenco of the driving factors behind the pricing of the key energy supplies of electricity, gas and coal.

This analysis has been broken down into two parts. Firstly the linkage of pricing of the energy supplies to other factors, primarily Crude Oil has been investigated. Secondly on the basis of the analysis a series of price predictions for electricity, gas and coal have been produced.

This analysis shows that over 90% of the movements in the historical wholesale prices of electricity, gas and coal can be explained by movements in the price of oil. At the same time the analysis shows that at very low levels of oil pricing the price levels of these key energy supplies reaches a floor level where fundamental production and distribution are more significant.

The future trend in the price of oil is based on a very wide range of factors across the global economy. These factors are discussed alongside of their potential impacts on oil pricing. From this analysis we have taken a forecast from the US Department of Energy's, Energy Information Administration to provide one scenario for oil pricing to feed into our models.

The output of the model is shown in Table 1.1 below

*Table 1.1 Intermediate Oil Price Scenario*

<b>Average yearly price</b>	<b>Oil (\$/bbl)</b>	<b>Coal (\$/tonne)</b>	<b>Power (£/MWh)</b>	<b>Gas (p/th)</b>
2007	72.31	86.42	42.71	40.95
2008	98.33	146.63	72.82	75.09
2009	63.99	74.22	37.78	35.43
2010	83.74	105.77	50.95	50.38
2011	94.26	122.59	57.97	58.35
2012	106.09	141.50	65.85	67.30
2013	113.93	154.02	71.08	73.24
2014	125.04	171.78	78.49	81.65
2015	131.84	182.65	83.03	86.80

Source: EIA (forecasts as of 16/02/09)

It is also important to recognise that around the base forecasts, factors outside of the linkage to oil prices will impact on electricity, gas and coal. Most notably are shifts in the balance of supply and demand. This was clearly demonstrated in the UK electricity market in the latter part of 2008 when there was real concern about a potential supply shortfall which pushed prices up significantly over a short period. We consider the factors across each of the three markets which could cause this type of deviation from the underlying trend.

The final conclusion of this analysis is that the use of oil prices as a proxy for electricity, gas and coal creates a powerful tool to develop future scenarios. This proxy relationship applies to a very wide range of oil pricing but any forecasts derived from the model must be treated with appropriate caution and only represent a guide to the possible market movements

## 2. INTRODUCTION

Wholesale power and gas forward prices can be shown to be highly correlated to the price of oil. The strength of this relationship means that predictions of oil prices can be used to forecast the trend of future energy prices using quantitative analysis.

*“predictions of oil prices can be used to forecast the trend of future energy prices”*

In this report *forward prices* relate to the weighted index price of two seasons ahead and hence indicate the wholesale costs of a 12-month contract starting the following October for the year in question. For electricity, the weighted price is based on a flat winter-summer profile with a 30/70 peak baseload split. The weighted gas price is based on a 60/40 winter-summer profile for gas usage. These price forecasts relate only to the wholesale element of energy pricing.

As the global economy begins to recover, a sharp increase in the price of oil is expected. One primary reason for the increase will be the resurgence in demand as business, move away from the short time working currently in operation and new businesses are created to meet the broader demand for products and services. The current economic situation and the significant oil price falls already witnessed may exaggerate this effect due to weak investment appetite in the oil sector. OPEC (Organisation of Petroleum Exporting Countries) is also likely to continue to restrict supply, to the benefit of cartel members. Under the intermediate oil price forecast (see figure 1.1), coal power and gas prices could more than double if oil increases to \$131/bbl in 2015, as indicated by EIA (Energy Information Administration) forecasts

*“coal, power and gas prices could more than double”*

Be that as it may, forward power and gas prices are subject to a number of factors other than the price of oil. Changes in supply and demand fundamentals in the power and gas markets may cause energy prices to deviate from the price of oil to some extent. Increasing UK reliance on imported gas and limited storage capability is likely to leave the UK more exposed to external supply-side shocks.

Furthermore, in the power market, tight generation margins may lead to price increases above that predicted by the oil price. The decommissioning of coal-fired plants prior to 2015 due to the LCPD (Large Combustion Plant Directive) increases the likelihood of this prospect. Changes the generation mix, as well as price volatility of associated markets, such carbon credits, may be contributory to deviations from energy price forecasts.

Of course it is recognised that by these forecasts only represent one possible scenario for the future price trends. Thus this report is intended as a *guide* to possible forward energy price increases that may be faced up until 2015. What is more significant is that the analysis shows that the movement of oil prices form an excellent proxy for the movement in other energy prices. The long term status of oil as a traded commodity means that a great deal of work is done on forecast price movements in the long and short term and this will enable the development of a wide range of scenarios to support our customers decision making processes.

*“coal, power and gas prices could more than double”*

### 3. ANALYSIS

The purpose of this report is to forecast the price of wholesale forward energy prices. The basis of this forecast is the future price of oil. This is because gas prices in the UK are indirectly linked to European gas prices and therefore the price of oil. Following the post-WWII reconstruction period, European gas contracts were linked by index to oil to provide an incentive to invest in gas-related infrastructure. The UK is interconnected to the EU through pipelines and the majority of EU gas contracts are indexed to the price of oil. Around 40% of UK power generation can be derived from gas-fired plant. Furthermore, coal is correlated to the oil market, and coal-fired generation also accounts for a sizeable proportion of the generation mix. Therefore the price of oil, through wholesale gas and coal prices is linked to the power market on the cost-side. The nature of the relationship between these markets is depicted in figure 2.1. The prices have been scaled to an index with a base of January 2007 to 'normalise' the data.

*“European gas contract are linked by index to oil”*

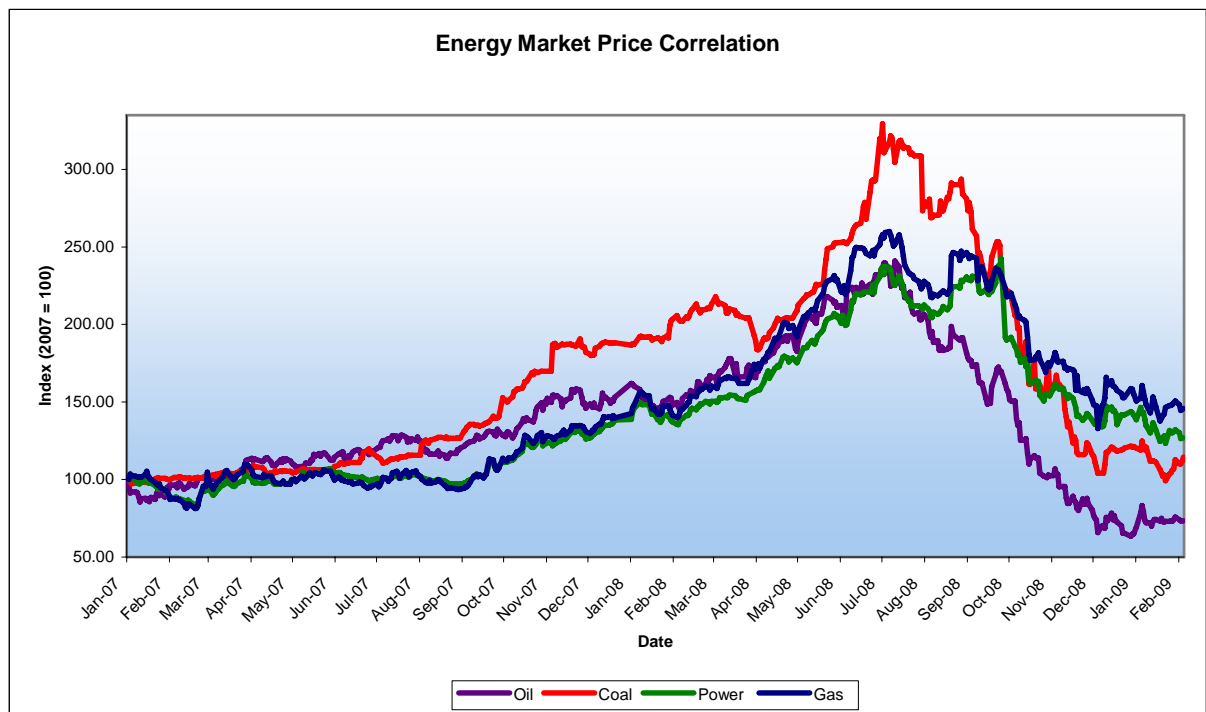


Figure 2.1 Source: Heren/ Spectron

The market data was analysed using linear regression followed by calculation of correlation. This showed that whilst the actual scaling factors varied across the three energy types, movements in the price of oil accounted for over 90% of the historical variation. More information is presented about this analysis in Appendix A.

*“Movements in the price of oil account for over 90% of the historical variation”*

It should whilst this relationship holds across the vast majority of the range of oil prices, there are indications of this relationship breaking down when oil prices are very low. This would suggest that there are intrinsic factors in the production of electricity, gas and coal which act to set a floor price for these supplies.

Also of interest is that whilst the indexing of European gas prices to oil involves a lag of six months, this lag does not appear to carry through to UK wholesale prices. This suggest that the liberalised wholesale market for energy in the UK is reacting quickly to changes in the oil market. This may be a feature of the extensive coverage that oil futures have compared to other forms of energy.

This our analysis shows that oil is a good indicator of the direction of the trend of energy futures due to the high correlation between such commodities. On this basis we will now move on to consider the factors likely to influence future oil prices and hence provide forecast for electricity, gas and coal.

## I. THE OIL MARKET

A review of the price of oil since 2003 shows a steady rising trend which persisted into 2006. At this point market sentiment, which had been concerned about tensions in the Middle East, the growth of demand and the risk of damage to oil installation from severe weather, turned and for a while the prices fell.

Oil producers followed their normal course of action and reduced output to support prices. In the first half of 2007, as concerns over supply shortage grew and demand growth picked up again particularly from Asia, prices rose quickly in a way that commentators at the end of 2007 described as “irrational”. As 2007 turned into 2008 this price rise accelerated until by the middle of the year it rose to over \$140 a barrel.

*“prices rose quickly in a way that commentators described as irrational”*

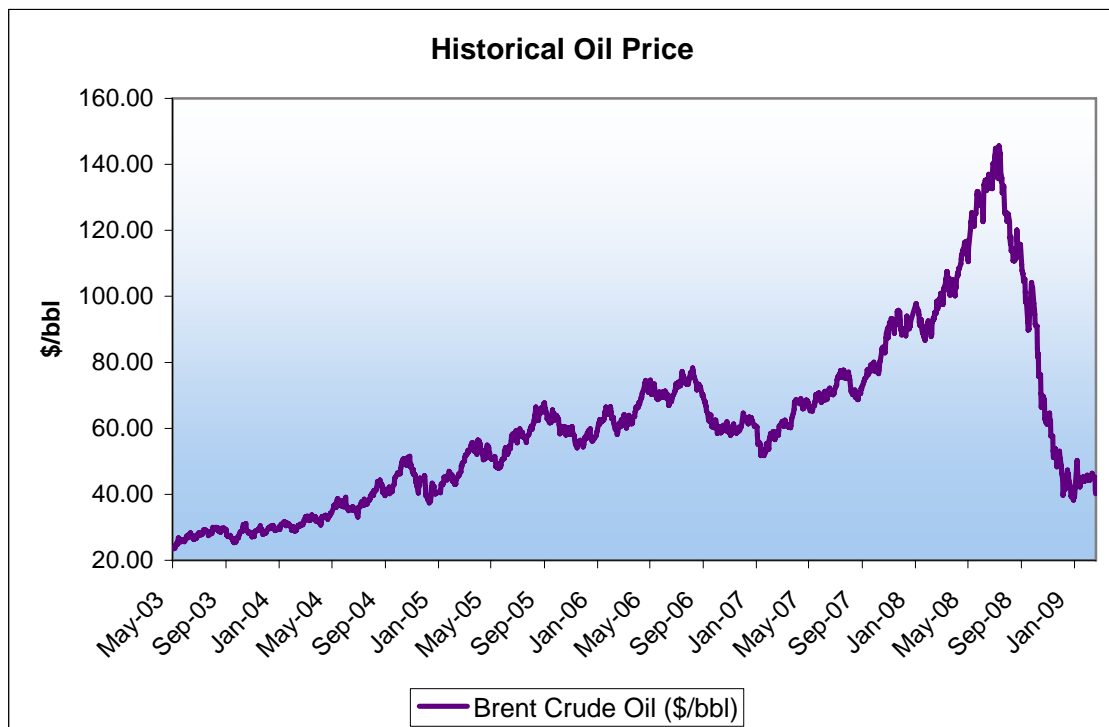


Figure 4.1 Oil price history Source: Spectron

At this point as the extent of the global financial crisis became apparent, prices turned down and plunged so that in six months they had returned to the levels last seen in 2005. Today future movement

awaits the signs of economic recovery and even production limits have had little effect on price levels.

#### **4.1 Demand**

The price of oil has fallen significantly since it peaked in July '08 as a result of the global economic recession and consequent oil demand destruction. Upon economic recovery, which is expected at the earliest in 2010 (International Monetary Fund), the oil price could accelerate steeply because economic growth is synonymous with high-energy usage. The Chinese economy had initially been expected to make up for the shortfall in global oil demand due to their rapid expansion. However, even China has not been insulated from the global economic recession and is now faced with slowing economic growth, unable to make up for oil demand lags in the wider economy. China and India are developing economies and thus are likely to become energy intensive in the medium term as industrialisation takes over. This is likely to create significant pressure in the market as oil demand is expected to outstrip supply growth derived from conventional oil sources.

*“oil demand is likely to outstrip supplies from conventional sources”*

#### **3.2 Supply**

The possibility of a supply shortage becomes particularly apparent when the current investment shortfall is taken into account. Investment projects in the oil sector are being delayed as a result of the weak oil price as well as the global economic recession and the financial crisis, which has rendered credit less accessible. For example, investment in unconventional oil sources such as Canadian Tar Sands and oil shale may suffer as the feasibility of such projects has diminished with the oil price. Supply from such sources had initially been expected to account around 5% total oil supply, however, oil supply from these sources may now deliver below previous expectation.

*“supply related time lags are expected as investment projects are deferred”*

Investment may increase upon economic recovery. However, supply related time lags are to be expected as investment projects are

deferred. According to the IEA (International Energy Agency) there could be a squeeze in oil supply as early as 2010 when oil demand is expected to pick up from outside the OECD (Organisation for Economic Cooperation and Development). This is likely to exert upward price pressure on the oil market as demand and supply balance tightens, with this escalating as the global economy moves into economic growth. Refinery utilisation is expected to increase with GDP (Gross Domestic Product) growth, which may ease pressure in the short-medium term. Utilisation has averaged at 84.5% since 1997, suggesting availability of spare capacity to expand production.

*“there could be a squeeze in oil supply as soon as 2010”*

OPEC accounts for roughly 40% of global oil supply. Therefore, the cartel holds a significant influence over the market and therefore the price of oil. The cartel is expected to strive to support the price of oil to the economic benefit of cartel members. Previous energy price increases have been absorbed relatively easily on a global basis. In light of this, any supply related oil price weakness in the future will probably be eliminated by the cartel.

The graph in figure 4.2 shows predictions of global oil supply and demand produced by the US Department of Energy.

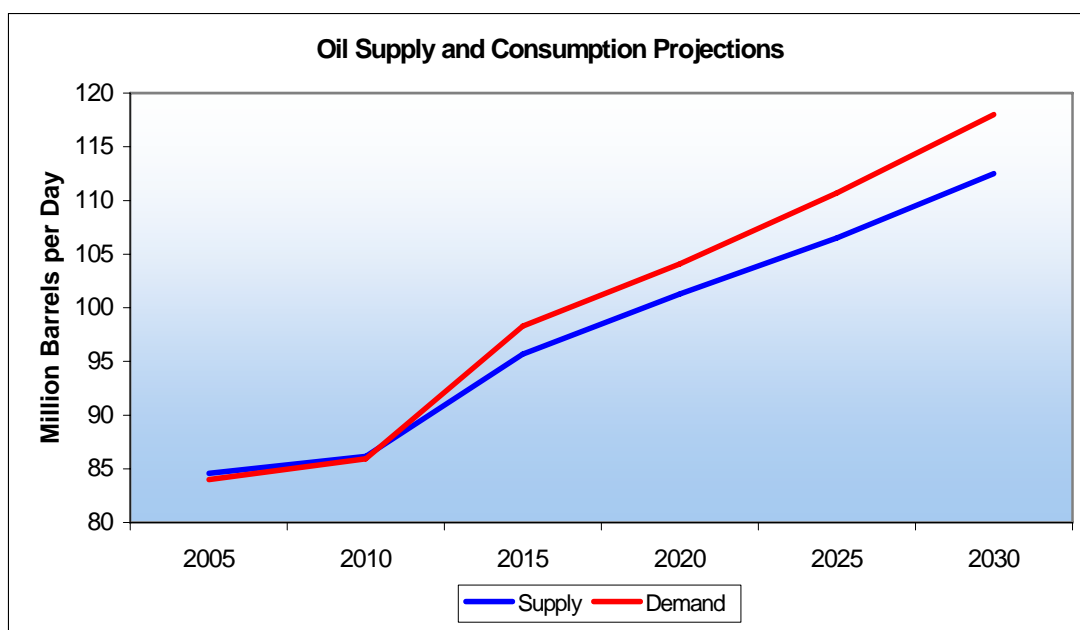
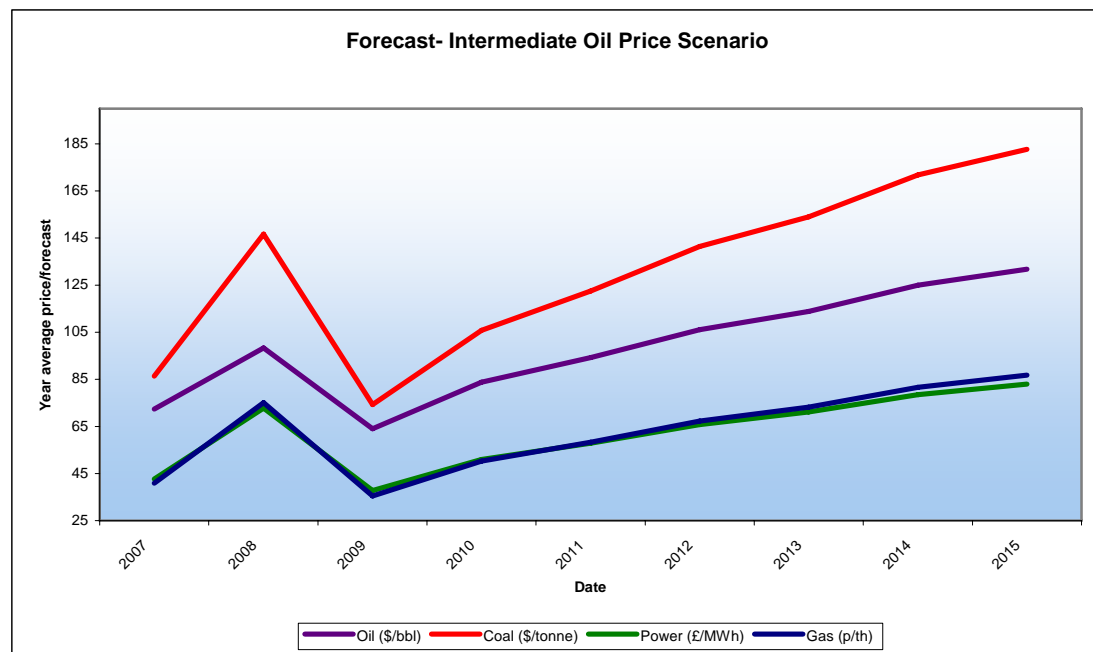
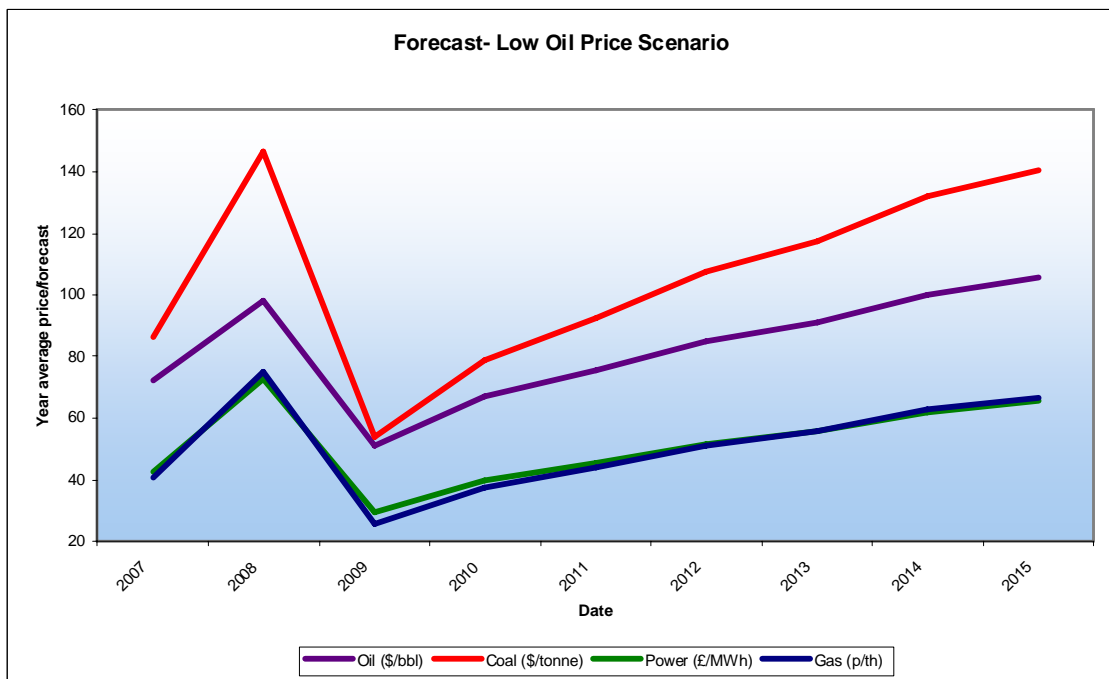


Figure 4.2 Source US DOE Energy Information Administration (EIA)

## 5. IMPACT ON THE ENERGY COMPLEX

With projections that oil prices will show upward movement as the economy moves out of recession, then our model predicts that the prices of electricity, gas and coal will move upwards as well. As well as our intermediate, base case, forecast we have also used additional sources to construct high and low price scenarios. The output from these models are shown below



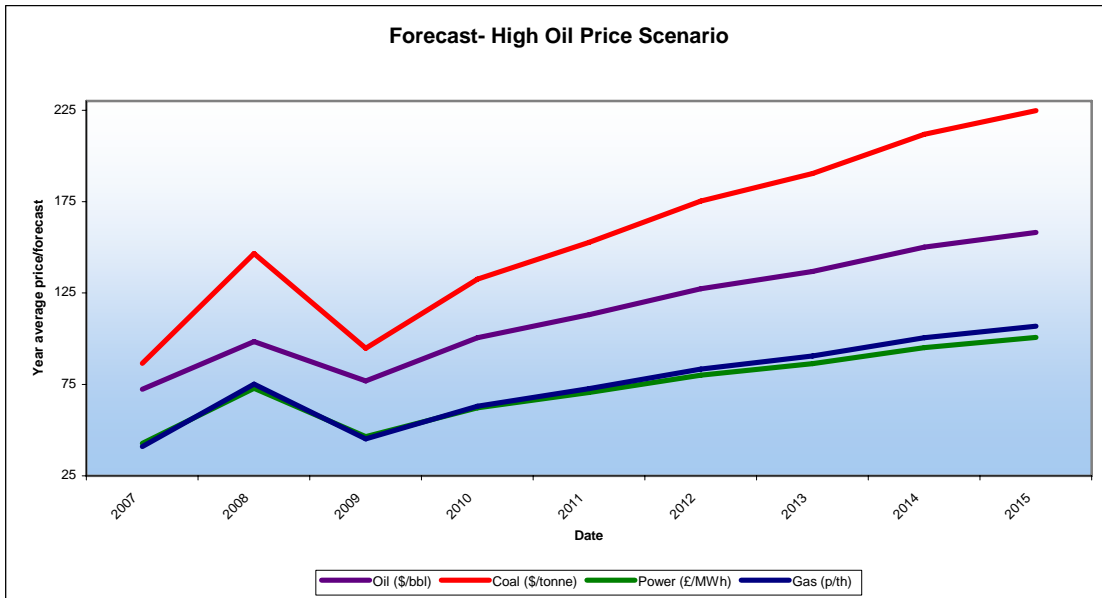


Figure 5.1 Forecasts of Oil, Gas ,Electricity and Coal Prices  
Source: EIA/ Heren /Spectron /Inenco Price Forecast

### 5.1 Other Factors - Gas Supply

Although the price of gas is highly linked to oil, supply side issues may lift the price over and above that predicted by the price of oil. The UK is a net importer of gas. This dependency is set to increase as the UK Continental Shelf declines, (See figure 5.2). Thus, the gas price may increase at a faster rate than Brent Crude oil as the UK pays a premium to Europe in order to attract Norwegian gas flows. Furthermore, due to the proportion of gas imports, the sensitivity of the UK to supply-side shocks, such as the Russia-Ukraine dispute, is likely to increase.

The possibility of this is acute when UK storage capabilities are taken into consideration. UK storage accounts for only 5% of annual consumption, compared with France at 25%. Therefore for gas security of supply is low and potentially could leave the UK more exposed to supply side shocks in the future. This may be mitigated to some extent by the planned increase in UK storage infrastructure.

*“for gas, security of supply is low and potentially could leave the UK more exposed to supply side shocks”*

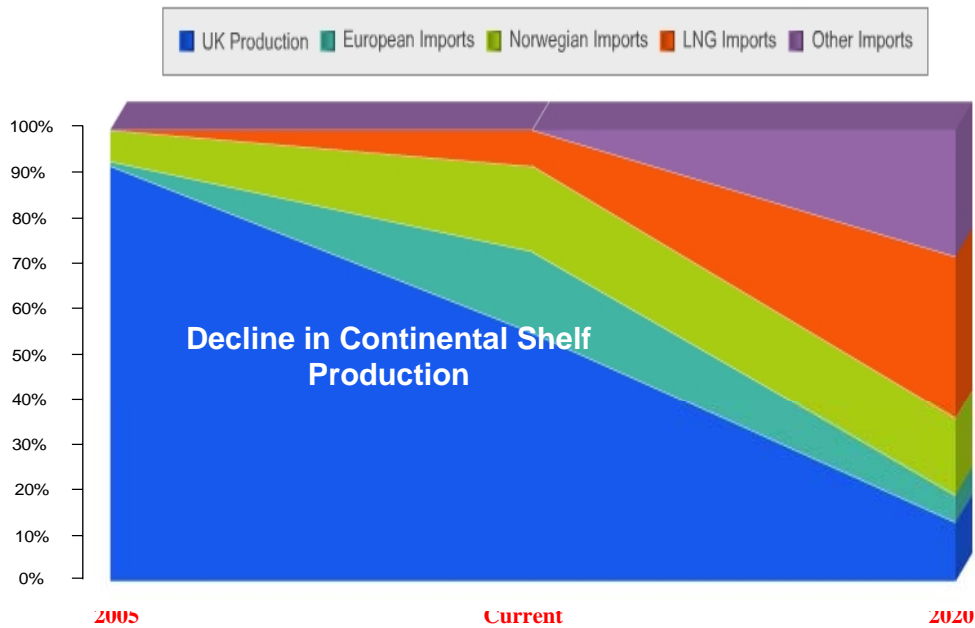


Figure 5.2 Sources of UK Gas Consumption Source: National Grid

The increasing import dependency of the UK is also likely to create exposure to the prices in the global LNG (Liquefied Natural Gas) market. The LNG spot market is subject to international competition. Thus, a premium may have to be paid in order to divert LNG cargoes to the UK in conditions of shortages. LNG contracts in Eastern Asia & Continental Europe are indexed to the price of oil. Therefore LNG is another avenue from by which higher crude prices could feed through to higher gas prices.

The impact of the oil price may vary depending upon different pricing structures. Thus, the link between the price of oil and LNG is imperfect and the extent of which price movement in the oil market feeds through to the price of LNG is likely to differ at times. Therefore, the price of gas may delineate from oil at times, possibly creating a variance in gas price forecasts.

### 5.2 Other Factors - Power Generation

Deviations from the forecast may result from the impact of generation shortfalls on the power market. Future expectations of tight power supply cannot be ruled out despite the current 'rosy' outlook for 2009.

Under the LCPD (Large Combustion Plant Directive) a number of plants have 'opted-out' of fitting emission-reducing equipment and are limited to run for a maximum of 20,000 hours in a 7-year period prior to 2015. Consequently, plant may use up all derogated hours before the deadline or run only when higher prices warrant the economic running down of hours. Thus, this is one constraint to power supply that may support the price of wholesale power.

*"The November '08 contract hit monumental highs of £150 /MWh"*

This issue is compounded by the ever present risk that the combination of planned maintenance and unplanned outages may combine to result in tight generation margins. The November '08 contract hit monumental highs of £150/MWh in anticipation of tight surplus generation margins. During the summer '08 period, Day-Ahead power out-turned above £100/MWh on many occasions due to tight power supply. This cannot be ruled out in the future. The aging UK nuclear fleet and associated generation unreliability compounds this risk.

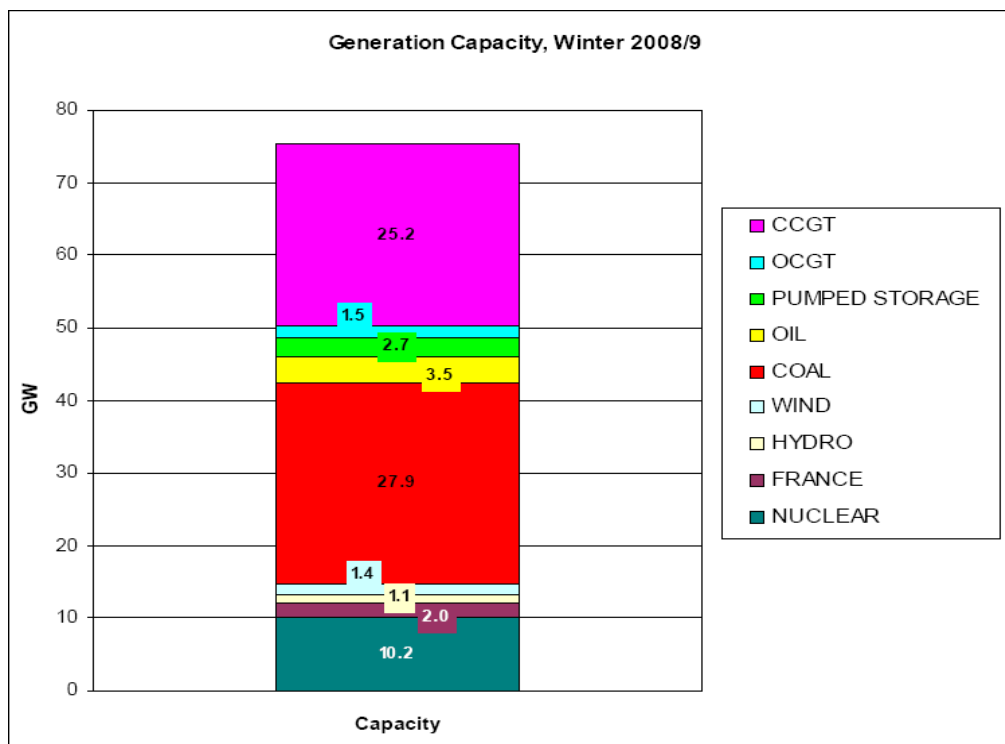


Figure 5.3 Generation capacity by source Source: National Grid

Power is generated using a variety of sources (see figure 5.3). The need for security of supply and the development of new technology means that the generation mix is now as diverse as ever. The relative combination of the various sources to the mix plays an important role in determining the price of power. This variation stems from the cost of fuel inputs, relative efficiency of fuel conversion, capital and operational costs and the cost of carbon emission permits via the EU-ETS (European Union Emissions Trading Scheme). The role of gas-fired generation is expected to account for an increasing proportion of power generation in the future as coal-fired and nuclear plants are decommissioned. Thus, the link between the gas and power price may progress as time goes on through the cost-side of the electricity market. Figure 3.8 represents increasing dependency on gas resource for power generation in the future.

*“the mix plays an important part in determining the price of power”*

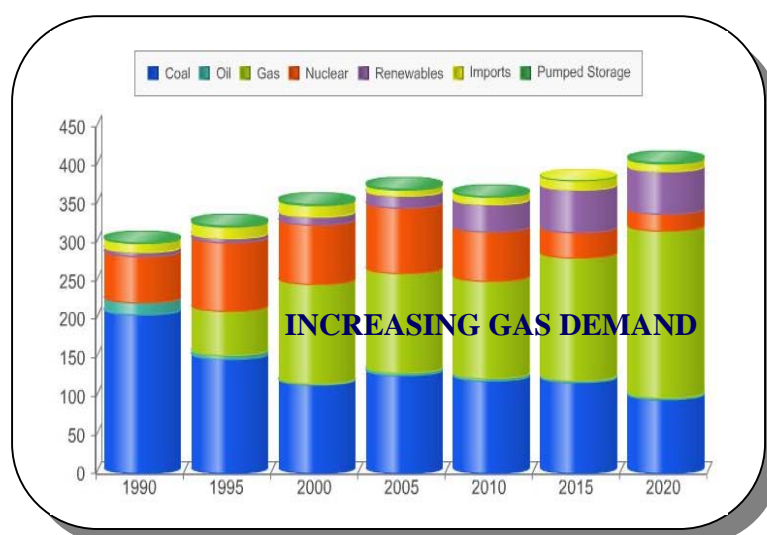


Figure 5.4 Forecast Generation Mix

### 5.3 Other Factors - The Coal Market

Devoid of any major supply shocks in the coal sector, the price of coal is likely to follow the fortunes of the oil market. Although coal is finite in supply, this is not a pressing issue in the medium-term. However, coal may be subject to demand-side pressure if economic growth following 2009 leads to a flight to coal. The growth of the coal market however is limited due to transportation and environmental constraints although it is low cost and widely available. Nevertheless,

*“although coal is a finite resource, this is not a pressing issue in the medium term”*

in the timeframe of this report it is assumed that coal will remain correlated to the oil market to a large extent. Thus the linkage of coal to power price deviations away from the price of power should be limited.

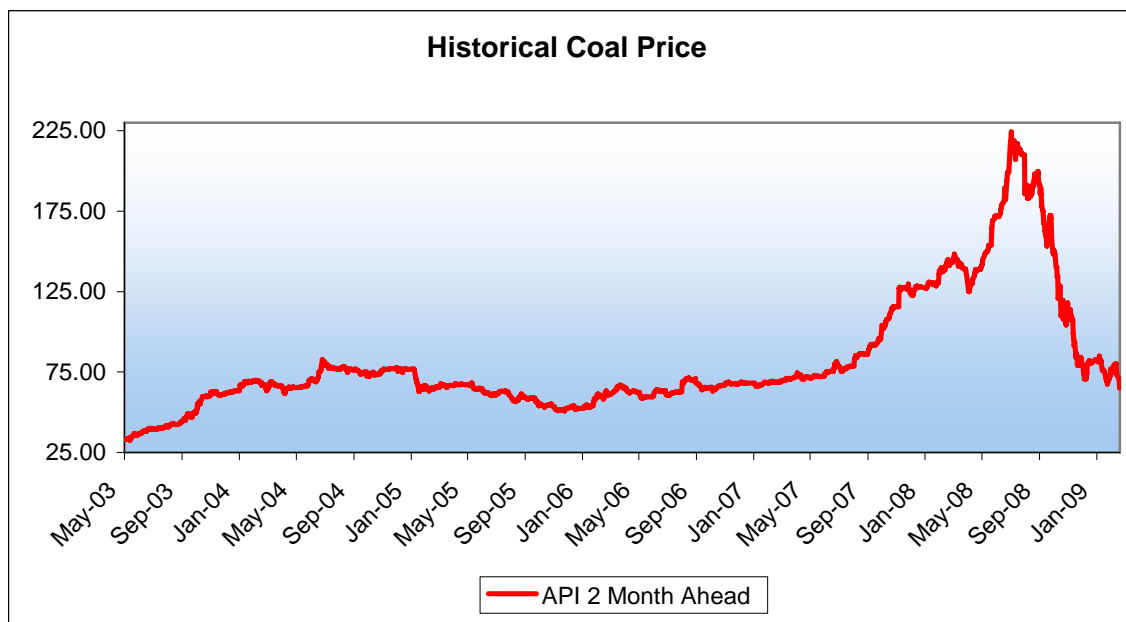


Figure 5.4 Coal Price History Source: Spectron

#### 5.4 Other Factors - EU Emissions Trading Scheme

The EU ETS is a mechanism that aims to decrease carbon emissions. A permit is needed to emit carbon, thus this in effect becomes a 'cost' to power generation, which is passed through to some extent in the price of power. The issue of carbon allowances falls with every 'Phase', accordingly, the price is likely to increase given falling supply of carbon permits. The incentive to invest in pollution abatement is the logic behind the scheme. However, the current economic climate has created a disincentive to invest. Thus, the proportionate cost of carbon allowances may increase in the long-term, creating another factor, which may create variances between the forecast and the power futures price out-turn.

*“the current economic climate has created a disincentive to invest”*

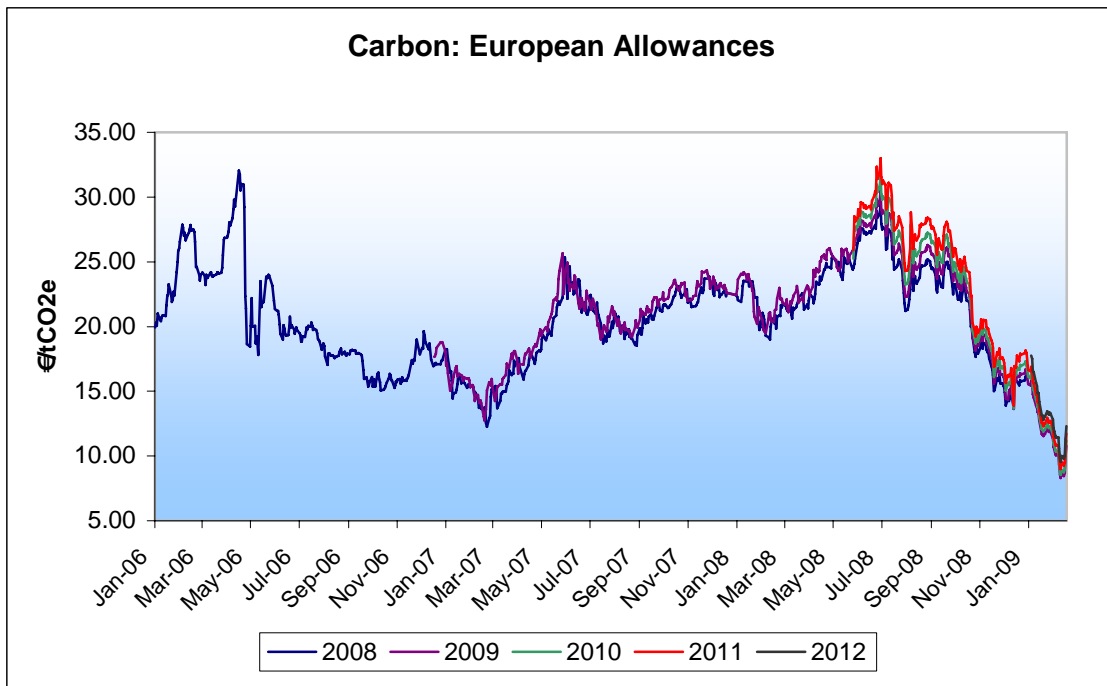


Figure 5.5: Carbon Prices under EU-ETS Source: Heren

## 5. CONCLUSIONS

It can be deduced that the price of wholesale power and gas futures is likely to follow the general trend in the oil market to a large extent. It must be stressed that the wholesale gas and power price forecasts relate to index prices of seasonal contracts, not spot prices. The indices are based on a 60/40 Winter/Summer profile for gas usage and a flat seasonal profile for power with a 30/70 peak baseload split and indicate the wholesale costs of a 12-month contract starting the following October, excluding transportation and delivery costs. However, variances may be caused as a result of factors that are impossible to account for in the model. Such factors could cause prices to diverge from the model. Real life can confound the assumptions of the model and the outputs must be treated with appropriate caution. Nevertheless, in this timeframe, forward power prices should remain highly correlated to the price of oil. Coal, power and gas price forecasts under relatively low, intermediate and high oil price scenarios are listed in figure Table 6.1. Years 2007-2008 are historical yearly averages. From 2009 and beyond, figures shown are forecasts.

*“real life can confound the assumptions of the model and outputs must be treated with caution”*

Security of power and gas supply is likely to become a pressing issue in the near future, which may cause gas and power prices to increase at a faster pace than accounted for in the model. This is an acute prospect when the current dampened investment climate is taken into account due to the global economic recession. The price of power and gas may ultimately depend on policy measures aimed at either security of supply or the environmental preservation. The apparent trade off between these two issues may cause severe price volatility around the forecasts. Thus the limitation of the model should be recognised in that it should be primarily intended as a guide to future price increases in the energy market

*“security of power and gas supply is likely to become a pressing issue”*

Table 6.1 Outputs from the Inenco Model

Low Oil Price Scenario

Average yearly price	Oil (\$/bbl)	Coal (\$/tonne)	Power (£/MWh)	Gas (p/th)
2007	72.31	86.42	42.71	40.95
2008	98.33	146.63	72.82	75.09
2009	51.20	53.76	29.25	25.74
2010	66.99	79.00	39.78	37.70
2011	75.41	92.46	45.40	44.07
2012	84.87	107.58	51.71	51.24
2013	91.14	117.60	55.88	55.98
2014	100.03	131.82	61.82	62.72
2015	105.48	140.51	65.44	66.84

Intermediate Oil Price Scenario

Average yearly price	Oil (\$/bbl)	Coal (\$/tonne)	Power (£/MWh)	Gas (p/th)
2007	72.31	86.42	42.71	40.95
2008	98.33	146.63	72.82	75.09
2009	63.99	74.22	37.78	35.43
2010	83.74	105.77	50.95	50.38
2011	94.26	122.59	57.97	58.35
2012	106.09	141.50	65.85	67.30
2013	113.93	154.02	71.08	73.24
2014	125.04	171.78	78.49	81.65
2015	131.84	182.65	83.03	86.80

High Oil Price Scenario

Average yearly price	Oil (\$/bbl)	Coal (\$/tonne)	Power (£/MWh)	Gas (p/th)
2007	72.31	86.42	42.71	40.95
2008	98.33	146.63	72.82	75.09
2009	76.79	94.67	46.32	45.12
2010	100.48	132.53	62.11	63.06
2011	113.11	152.72	70.54	72.62
2012	127.31	175.41	80.00	83.37
2013	136.71	190.43	86.27	90.49
2014	150.05	211.75	95.17	100.59
2015	158.21	224.80	100.61	106.77

Source: Oil Price Inputs EIA (forecasts as of 16/02/09); Heren

## 7. TERMS OF USE

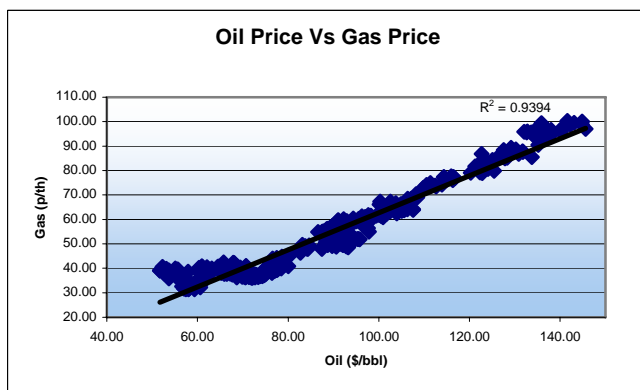
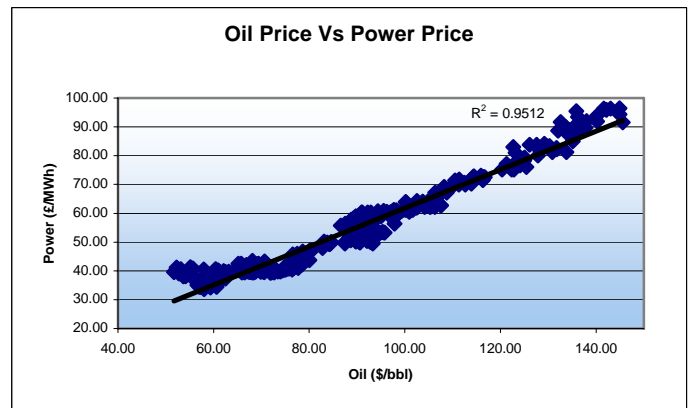
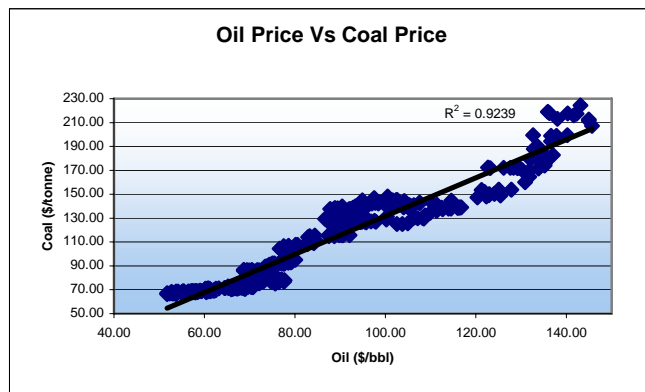
Whilst this report provides market information and forecasts this is not provided as advice. Inenco accept no liability for any damages or losses of whatever kind suffered as a result of the use of any information contained within this report.

Energy markets are extremely volatile and forecasts / prices can change significantly in very short periods of time.

# APPENDIX

## 1. Methodology

The oil, coal, gas and power markets follow a similar trend. The nature and extent of this relationship has been explored using linear regression analysis. Upon economic recovery, the oil price will most likely trend upward. In light of this the sample data used in order to determine the relationship between the aforementioned commodities related to the up trend in the oil market from January 2007 until the peak in July 2008. Analysis confirmed a very strong link between oil and the dependant variables. The correlation coefficient (R-squared) in all analyses was above 0.9. This confirms that a very strong link exists. During the uptrend over 90% of price increases in the coal, power and gas markets can be accounted for by the strengthening oil market. Regression analysis of the relationship between oil, coal, gas and power is depicted below.



On the basis of this, forecasts of coal, gas and power have been deduced using a statistical formula of the relationship between oil and each of the dependent

variables. The value of 'x' (oil) has been taken from EIA (Energy Information Administration) crude oil forecasts.

A more robust econometric model of wholesale gas and power price trends would include a wider range of independent variables, such as surplus generation forecasts, price elasticity, rate of technological change. However, this type of forecasting is beyond the scope of this report and thus it is assumed that all other variables remain constant during the forecast timeframe.