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Friday, 20 November 2009

Ian Marlee
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Ofgem
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Dear Ian and Kersti,

Re: Project Discovery, Energy Market Scenarios

Thank you for the opportunity to respond to the above consultation document. This non confidential response is on behalf of the Centrica group of companies excluding Centrica Storage Ltd. We are happy for this response to be placed on the Ofgem website and in the Ofgem library.

Overall we are strongly supportive of the approach of using scenarios to consider the future prospects for secure and sustainable energy supplies and the potential market impacts of the difficult choices which need to be made. We also agree that stress testing such scenarios is essential and welcome the work which has been done so far under Project Discovery.

Related work has been carried out in a number of fora (such as the LENS work, the Gone Green work by National Grid and the Anticipatory Investment discussions at ENSG) and it is important to ensure that this is pulled together.

We understand that this is the first stage of a three stage process and that whilst this consultation is ongoing, Ofgem has continued to the next stage of the project, reviewing the market arrangements. If there are areas which require change, a third stage of identifying policy responses will ensue.

Centrica believes that there are a number of issues with the scenarios, partly stemming from a lack of transparency with regard to the assumptions. It would be beneficial to place the actual

model in the public domain so that it is available for review and challenge at a detailed level. This should be followed by time to assimilate the responses to the consultation document; appropriate adjustments to the model and a further iteration of these scenario outcomes before using the results to determine whether changes to the market arrangements are required.

In terms of the actual approach followed, we believe that ranges around the four main scenarios would be better, given the significant uncertainties associated with making detailed assumptions this far into the future. In general we agree that as potential events the stress tests are reasonable, but that consideration needs to be given to the interaction between the events, the relative strengths of the impacts and whether the impacts would change over time.

Our response document, attached to this letter includes three sections:

1) Key issues
2) Answers to the consultation questions
3) Questions raised, not addressed elsewhere

We would be happy to discuss our response with you in more detail if you would find this helpful, and can be contacted on the number above.

Kind regards

Yours sincerely,

Sent by email

Alison Russell
Senior Regulation Manager, Upstream Energy

Section 1: Key issues

This response is in two parts, section 1 seeks to address key issues plus more general points whilst section 2 considers the specific questions posed in the consultation document. Section 3 lists questions that we have in response to the document. We would be happy to discuss these questions in more detail and hope that Ofgem will be able to clarify.

Centrica is supportive of the concept of the project based scenario approach. We agree with the objective of examining the prospects for secure and sustainable energy supplies in the future. It is important to have a wide range of scenarios from different perspectives in order to determine any critical areas that using only one methodology may not pick up.

Ofgem has correctly identified many of the key issues, for example; the retirement of existing plant; the high levels of investment required to secure energy supplies and meet carbon targets; gas import dependency; and changes to the way in which we generate/produce and use energy. However we do have concerns that the document has insufficient granularity in the data and the assumptions lack detail. Given the importance of this work, we would encourage Ofgem to place the model and full reasoning behind the assumptions in the public domain, so that it can be examined and challenged properly, before basing conclusions or further work on it.

Currently, there is a huge amount of uncertainty about the energy future and how security of supply can be achieved whilst meeting binding environmental targets and decarbonising our energy. The choices the UK makes in the next few years will determine whether or not we meet the challenges of climate change and how affordably. These choices are largely irreversible due to both the cost of installed plant and projected asset life, and the lead time for such decisions. This lead time means many major investment decisions need to be made in the short term whilst there is still great uncertainty about the regime in which they will need to operate for the lifetime of the asset.

As we noted in our recent response to the call for evidence by DECC, a unique opportunity exists to facilitate the required transformation over the next few years on the power side, as a result of the large amount of conventional plant that will have to close under emissions legislation or through age. The deployment of smart meters and development of smart grids will be a key part of the future. Whilst low carbon generation will assist in delivering solutions to climate change and security of supply, the extent to which investment favours low carbon generation rather than conventional technology will be heavily dependent on government policy and incentives. The current low carbon technologies require extensive upfront capital costs to deliver low marginal cost power, in our view there is, therefore, a significant risk of price cannibalisation.

Centrica agrees with the view of the Committee on Climate Change that nuclear is the cheapest form of low carbon generation and it will need to play its part in the future, however, the current framework may not comfortably support new nuclear build and it is only in Ofgem's green scenarios that this role for nuclear is recognised. In addition, intermittent wind generation will require back up, particularly at peak times. Whilst the possible lack of wind is used as a stress test and in both the green scenarios the risks associated with intermittency are noted, the scenarios do not address possible market requirements to provide adequate incentives and reforms for low load factor flexible plant on the system.

We agree with the recognition that demand side response will have an important role to play in providing future system security. However, it is unclear from the document to what extent the full potential of the demand side has been captured in the scenarios and stress tests – for example in potentially mitigating the need for investment in some parts of the networks. This

could deliver material benefits for customers in terms of avoiding material increases in network charges.

The document sets out that this is the first stage of a three stage process: seeking views on the scenarios used by Ofgem to consider the energy market. This will be followed by consideration of the appropriateness of market arrangements and possible policy responses. As such, the scenarios do not lead, of themselves, to any particular conclusions either directly or indirectly. On this basis, it is difficult in some cases to comment specifically in response to particular questions or to assess the “fitness for purpose” when the usage of the scenarios is not always clear and there are other models / scenarios, equally valid being developed in other arenas.

Section 2: Responses to Consultation questions

CHAPTER: Two

Question 1: Please provide comments on our approach of using scenarios and stress tests to explore future uncertainty, and as a basis for evaluating policy alternatives.

Centrica agrees with the use of scenarios; however as the project is looking over two decades out, the inputs (such as carbon prices and LNG supply) are both unpredictable and complex, it will naturally have limitations. We support Ofgem's approach of asking for comments and advice on the both the outline and detail. We are happy to participate in this process, but as we have previously stated, in our view the scenarios lack granularity, especially in terms of the assumptions made and associated sensitivities. On this basis we believe that there need to be caveats about the strength of the model and underlying assumptions. We are also unclear as to why Ofgem has elected to use a 1 in 20 severe winter rather than the more standard UNC 1 in 50 definition. We would appreciate further explanation of this point.

Sensitivity analysis would be very useful. Identifying those inputs that have a material impact on the scenarios would help focus the next phases.

We may wish to comment further once greater detail is available, but at present we do not have a firm sense of whether the model, assumptions and conclusions are internally consistent.

We believe there are a number of areas in which improvements could be made, and would encourage a further iteration of the scenarios with industry to build in the comments and inputs received to the next stage of the process.

We are unsure how reflective the scenarios are in some cases, for example, low demand may not always lead to low prices. In the Slow Growth scenario, the price assumptions appear relatively low with the modest demand growth, but do not reflect the risks of market tightness resulting from an unwillingness to invest in a low growth scenario.

A further specific example is that in figure 3.4 the net interconnectors do not become positive until 2016, it is not clear whether this includes netting of exports and also whether the GB peak table makes sense with the assumed price levels. Also we require further clarity if this data takes into account BBL, or Ireland, plus the other planned interconnectors. For example a key issue is whether GB gas prices are higher or lower than prices in near Continental markets.

One of our main comments relates to the apparent "smoothness" in each of the scenarios. There will always be a degree of cycling in the market and if taken literally, the smoothness could lead to faulty conclusions. We believe that it would be better to show a range of prices around the central assumption (including summer/winter prices), rather than an overly smooth and consistent wholesale price path. In addition, the "smooth" scenarios do not capture the increase in wholesale price volatility (for either electricity or gas) which is likely to result from large scale intermittent wind generation.

Looking at electricity specifically, prices are likely to need to be spiky to bring on/maintain backup. These market signals may be unpalatable even though necessary. We are also unclear why electricity demand is so similar in all scenarios, though gas demands are significantly more variable. In the Green Transition scenario, we would expect a lot of decarbonisation to be provided by electricity and hence there would be an upward pressure on power demand. We would like to further understand Ofgem's approach in this area, for example whether heat pumps and energy efficiency are assumed to offset demand and to

what degree. Depending on the Electric Vehicles (EV) and Heat Pump (HP) assumptions the electricity demand may be very peaky or very flat with potentially very different impacts on prices. We believe that EV and HP assumptions are becoming critical to any assumptions for Smart Meters and Smart Grids and hence future demand.

In terms of the duration of the analysis, we are uncertain why a cut off date of 2020 or 2025 has been chosen and why the same date has not been used consistently. In electricity in particular our view is that the 2025+ period merits close examination. Ofgem should also consider aligning scenarios to the economic duration of the assets.

Question 2: Are there other techniques for analysing uncertainty that we should consider?

It would be very helpful to provide a range around the initial scenarios, perhaps high and low envelopes, to reflect the prospect of market cycling for each as well as some distributional analysis using a tool such as Monte Carlo simulation. We would support the inclusion of some probabilistic modelling to complement the other tools used, as this should provide additional insights.

In terms of the uncertainty, given the difficulties of pushing the analysis into the future, we believe the issues are more around the quality of the assumptions and the detailed understanding of their interaction in the modelling rather than the specific numerical outcomes. [Could this be interpreted as the assumptions integrity is more important than the output rather than – we need to get the assumptions and interactions right in order to have confidence in the outputs]

Question 3: Do you agree with how we measure the impacts of our scenarios and stress tests?

The analysis is significantly less complex than that used under LENS and it does not include customer take up as one of the key drivers, which we believe to be important.

As we understand the model, it is assumed that policy and economic growth are inputs and prices are outputs. In fact some output on the gas side appears to be measured as unserved demand, which we are not convinced is a realistic view of what the impact might be.

The effect of this is fundamental in that the scenarios do not demonstrate a role for wholesale prices in bringing supply and demand into balance. Significant unserved gas demand is shown in several scenarios, whereas we believe that in reality, wholesale prices would rise in such circumstances, attracting any “uncontracted” supply and/or stimulating a demand side response. If this is addressed in the scenarios, it would be helpful for the relevant areas in the assumptions to be highlighted, as well as linking to the global situation as, for example, LNG may be the marginal supply.

Noting some of the specifics around wind, the stress test is applied to a 1 in 20 peak day, but does not address what might happen in a more extended period with inadequate wind, for example 5 or 6 days as happened last year over Christmas. In addition, the analysis does not consider the interaction of stress tests.

The specific stress tests are very different in terms of their probability and impact. For example – in our view wind intermittency (even some days without wind at all) should be assumed to be within normal parameter, rather than a particular “shock”, whilst the loss of a major terminal or 40% of LNG would be a significant event. We would therefore expect the model to be fairly resilient to wind intermittency but less so to the loss of a major gas terminal.

There is insufficient explanation of scenarios and further breakdown of the scenarios including the assumptions would be helpful. For example, the assumptions against the centralised model on penetration volumes of microgen, heat pumps etc.

Question 4: Do you agree with our key scenario drivers and choice of scenarios?

In some ways, the choice of drivers appears a product of the time Project Discovery was initiated. The scenarios focus on economic recovery (or otherwise) whereas it seems likely that when looking ahead 10-20 years the impact of a recession in 2008/09 will be muted. (For example, 2.29 suggests low energy demand yet the analysis is looking through to 2020.) There are bigger developments likely – smart grids/meters, wind intermittency, nuclear new build, CCS etc and it would be desirable to take some of these areas into account.

Looking specifically at the concept of economic recovery, greater clarity on whether this is global or UK recovery would be helpful. It would also be useful to build in assumptions around oil, oil shocks and constant exchange rates

Question 5: Do you believe our scenarios sufficiently cover the range of uncertainty facing the market, and hence cover the areas where future policy responses may be required?

The levels of uncertainty in the market are probably broader than implied, and the scenarios do not capture a big enough range of uncertainty for any particular year. Of particular interest is the degree of Demand Side response assumed and its potential role as a provider of reserve and frequency response. There are wide ranging views with significantly different outcomes.

As with the earlier comments, the issue of “smoothness” is a problem. We would suggest that as an example, one could take an approach as follows: in any year taking a loose, tight and balanced system and then stress testing each of the views. It is very difficult to consider that the range of outcomes has been addressed without running significantly more variants. It would also be worth testing opposites, such as Gas tight, Electricity loose etc.

However, it also appears as if there are two distinct scenarios with a high and low case for each. Take wind capacity in 2020: we have 28.5 GW & 27.2GW versus 14.2 GW & 13 GW, but there is a lack of middle ground. Given the impact of wind on power generation – and thereby gas demand – this seems too large a gap between scenarios.

Similarly, the difference between “Other renewables” seems conservative between the scenarios. By comparison, the CCS assumptions are significantly different; varying between too costly and an opposite extreme of 7.2 GW by 2025.

Question 6: Do you have any specific comments on scenario assumptions, and their internal consistency?

On the gas side we would consider a greater degree of seasonality, and in the green scenarios the requirement for gas backup is likely to be peakier though it is probably directionally right.

However, we do not understand the treatment of gas storage and the levels assumed which in some cases appear to be less than current levels. In fact one would expect more storage

capacity to be required by rising gas demand in some (non-green) scenarios, and, with a different profile, to support greater thermal back up generation in the two green scenarios.

In addition, the import/export swing of interconnectors from France, Norway and Ireland does not appear to be accounted for.

We believe it would be helpful to consider a sense check on the scenarios, for example, in order to measure outcomes the clean spark spreads could be calculated and reported as a consistency check across the gas and electricity markets in each scenario.

We agree that LNG will play an increasingly important part in meeting the UK's supply requirement. However, we have concerns about the assumption that LNG will respond perfectly to market signals. Liquefaction projects in particular are very long lead time projects – for example the amount of liquefaction that will be operational in 2015 is already capped as it takes around six years to build a liquefaction unit. Even in the shorter term LNG may not respond to short term price signals due to the constraints in the supply chain (e.g. quality, shipping or sourcing replacement gas). In addition, decisions to invest in liquefaction projects are heavily influenced by the political situation and domestic gas requirements within the producing country.

Question 7: Do you agree with our methodology for modelling gas and electricity supply/demand balances?

As stated earlier in this submission, until there is greater transparency regarding the model and its assumptions, or ideally the model is placed in the public domain, we cannot categorically confirm whether we agree or disagree with the methodology. As a starting point for modelling the electricity supply/demand balances, calculating the short run marginal costs of the marginal plant and then uplifting prices appears suitable, however, further information is required. For example, how are interconnector flows modelled (which in turn leads to questions over Continental power prices and assumptions regarding German nuclear life extensions and Continental wind).

On the gas side, we would support the general approach of building up supply in the order shown: UKCS, Norway, LNG, interconnection. However, as noted previously, more detail on interconnection would be useful (e.g. would BBL be used differently to IUK and how are exports to Ireland treated?)

It would also be wrong to assume that imported volumes will arrive simply because we have the capacity. We need long term supply contracts to be more confident of supply security, particularly for LNG (as noted in the answer below).

Question 8: Do you agree that LNG is the likely medium-long term source of "swing gas" for the European market

We disagree with this contention; LNG can function as a swing supply only to a very limited extent. Price signals may attract a nominal number of LNG cargoes from suppliers seeking to optimise their portfolios. Traditionally, LNG contracts have a degree of rigidity that limits the ability of LNG to behave as a swing supply. This is likely to continue in the medium to long term. On the Continent, the structured gas market favours long term contracts which may limit "swing gas" derived from LNG.

We believe that the current gas market conditions could be considered rather unusual and hence this is not a good basis to use for assumptions covering a 10-15 year period into the future. Whilst "uncontracted" LNG might provide a significant swing supply at certain times, this cannot be relied on in the medium or long term given the economic fundamentals of the LNG supply chain and the resultant incentives towards long term contracting

LNG as a swing supply can be prohibitively expensive and exhibit high volatility. Asian buyers that purchase swing LNG often do so at a premium. Swing gas for the Continent need not necessarily come from LNG. This has been demonstrated in the current downturn where Continental European import turndown has come primarily from a reduction in Russian pipeline gas offtake. However, this degree of flexibility is unlikely to continue in the long term as it has detrimental effects on suppliers' upstream investments.

In addition, unconventional gas supply is growing in North America, and this may also release some individual LNG cargoes. It may improve availability of cargoes in a limited way, but could not really be described as swing gas.

The UK has demonstrated a higher degree of flexibility in their approach for importing LNG and selling into a liquid traded market. This is a reflection of UK market conditions relative to the Continent. However, even in the UK the ability to attract meaningful volumes of LNG through price signals remains limited.

Other sources of swing gas to GB will include the interconnectors; however, it is essential to be more explicit about the assumptions around net gas flows to/from the Continent given (in particular) the swing role of IUK and the unresolved issues with gas quality.

CHAPTER: Three

Question 1: Do you have any observations or comments on the scenario results?

As part of our own modelling processes, Centrica considered gas demand in central, low and high cases. Whilst providing a significant range of results, this did not produce the scale of the gas demand shown in the 'Dash for energy' and 'Slow growth' scenarios. We do not assert that either view is correct at this stage, but would wish to see a greater degree of granularity in the data and more of the underlying assumptions and associated reasoning so as to try and establish a causal track for the differences.

As a specific observation on the electricity side, it is not clear whether the de-rated capacity in 'Slow Growth' would actually be sustainable without their being a price signal and subsequent capacity response.

The conclusions to chapter 3 suggest that greater gas demand would lead, possibly inevitably, to a greater range of potential supply shocks. We are not clear whether this is in fact the case or simply that it might lead to different supply shocks depending on the relative positions in other markets. With a diverse range of supply sources, sufficient storage and a robust regulatory framework, it is not clear that increased demand would necessarily massively increase risk.

In considering LNG specifically, we agree that future growth will come from China & India with limited LNG imports into the US.

However, the Dash for Energy scenario assumes rapid growth in liquefaction capacity. This may not be realistic as few liquefaction project final investment decisions are currently on the horizon. The Henry Hub prices currently seen do not appear to support major investment in

new capacity and LNG producers may perceive a lack of market depth. This may lead to a supply crunch, potentially sooner, and a significant supply gap.

Question 2: Do you agree with our assessment of what the key messages of the scenario analysis are?

Whilst supporting the scenario based approach, Centrica has set out a number of questions and concerns about the detail of the assumptions, and therefore the results of the analysis.

Given the importance of this work to the industry we would encourage Ofgem to place the model in the public domain and allow parties time to examine and challenge the model before basing further work on the outputs. We would be happy to co-operate with a workgroup to carry out this process.

Question 3: Are there other issues relating to secure and sustainable energy supplies that our scenarios are not showing?

In the light of the points raised above, we are only able to provide limited insight to this question.

Based on the information available, we believe the assumptions and scenarios fail to recognise the requirements for anticipatory investment and do not give sufficient prominence to the issues around smart meters and smart grids. However it is notable that though Transmission and Distribution costs rise over time, whilst BSUoS costs are assumed to fall by 2015. This seems uncertain as generally one would expect BSUoS to rise and in particular at least track wholesale electricity prices and hence the data seems inconsistent.

In terms of the cumulative track of transmission and distribution charges (page 95); we believe that more detail is needed on the underlying assumptions and how the figures are related to the current revenues of the network companies. We have tried to consider this, but were unable to reach a conclusion.

Looking at the wider electricity market, we believe that the assumptions should take account of issues such as market coupling and increased interconnection between markets, over and above the assumed 1GW addition; these seem very low given the current interest in interconnection and projects undergoing feasibility studies.

In terms of gas issues not covered, the key ones appear to be issues around import gas quality, which has recently come to the fore again and the ability of LNG to flex in accordance with demand.

The key point with import gas quality relates to the quality of gas from the Continent, especially via IUK, where if the issues are not resolved, this could lead to a reduction in gas being tendered to the interconnector, or even this no longer being a potential source of gas for the GB market.

Major LNG exporting countries (e.g. Nigeria, Qatar, Egypt, and Indonesia) have faced a struggle to increase exports due to rising domestic demand, or demand from regional neighbours. This may limit the ability of suppliers to react to a rise in external demand, reflecting the tight LNG market experienced from 2005 to mid 2008.

Question 4: To what extent do you believe that innovations on the demand side could increase the scope for voluntary demand side response in the future?

Smart demand would appear to have a lot of potential for offering cost-effective solutions to some of the issues within the future electricity sector. The applications can be considered by type of response, as shown below:

- Real time demand response – for frequency control which could be achieved by making future appliances "smart" such that they can temporarily reduce load if they detect the system frequency dropping. In the interim, "smart plugs" might provide a stop gap alternative.
- Demand shifting within day – moving demand away from known times of peak demand – e.g. mornings and evenings. This can readily be achieved via time-of-use tariffs and smart meters.
- Dynamic response – this is changing customer demand at close to real time to provide additional demand side flexibility. It could take the form of applying a maximum demand level via the smart meter (for those customers signed up on that discounted tariff option). This could either be a simple limit on demand or implemented much more cleverly via the home network managing the suite of appliances running in the home at that time. The latter offers the opportunity of providing additional demand when surplus renewable power is available by scheduling loads that are flexible in timing such as dishwashers or car charging. An alternative is to send out critical price alerts to certain customer groups identifying upcoming periods of exceptional high or low price, and leaving it to the customer/supplier to manage how their load responds.
- Demand reduction – from better information delivering improved energy efficiency and more customer awareness of consumption.
- Demand reduction – from home automation which makes it easier, and therefore more likely, that customers will take steps to reduce demand. E.g. easier to use remote control to control boiler operations, thermostats, variable room temperature settings, lighting, etc.

What all these have in common is the need for smart meters, the necessary communications infrastructure, a home network to enable meter-to-appliance communication and a new settlements process to convert smart metering data into customer bills, coupled with developments in home automation and appliances.

Fuel switching does not appear to be considered in the scenarios, which could significantly affect demand.

Demand side response may also play an important role in mitigating the need for investment in networks. By reducing and/or moving demand away from peak times, this may relieve congestion on networks at key times, therefore removing (or at least delaying) the need for network reinforcement. This could deliver material benefits for customers in terms of avoiding material increases in network charges

CHAPTER: Four

Question 1: Do you agree that our stress tests are representative of the types of risks facing the GB energy sector over the next decade?

Overall we are of the view that the tests themselves are reasonable as far as they go, but greater clarity is needed on what the tests are seeking to demonstrate. It would also be expected that these scenarios would need to change and develop over time. For example the building of pipelines such as Nordstream and Nabucco would be expected to mitigate the impact of a Russia-Ukraine type dispute in the future.

Looking at specific points, the wind test in particular should be considered over longer than a single day. The electricity interconnection capacity assumption seems conservative in the light of construction commencing on BritNed and further commercial plans having been mooted for Norway, France and Belgium.

Question 2: Are there further stress tests that you think should be considered?

Further questions include the debate as to whether it is right to restrict the tests to serving energy to whether in addition the effect on prices should be modelled under each stress test (and the additional range of scenarios proposed).

We would strongly recommend that in addition to the tests set out, the interactions between tests should be examined. For example:

- 'No wind' is almost certain to occur at some time during either LNG re-direction or a Russia-Ukraine dispute.
- LNG supply re-direction will affect Belgium and the Netherlands as well as the UK, their market prices are close to the NBP price and they suffer from the same lack of long-term contracts. Shortage of LNG in those countries is likely to lead to reduced running of CCGTs and a need for electricity interconnectors to be in full export mode.

Overall it is not unlikely to get significantly worse impacts than the individual stress tests and interactions are probable. As highlighted by the second bullet above, a number of the tests and interactions will impact more than just GB and hence it is important to properly consider cross border flows as Europe becomes more interconnected and energy more global.

Question 3: Do you agree with the assumptions behind our stress tests?

Further assumptions that could be considered are impacts on cross border flows, the potential wind and nuclear manufacturing supply chain delays as well as the pattern and existence of network constraints.

We would like to understand in more detail the assumptions that have been made regarding electricity demand-side response, as set out on page 99. We do not believe that historical observations of demand-side destruction are a good indicator of the future potential for demand side response, given the advent of smart meters, and the general increased profile and importance of energy efficiency measures.

Question 4: Do you have any views on the probabilities of these stress tests occurring?

It is difficult to assess probabilities of the stress tests, but we believe that it should be possible to form a view of the likelihood of the wind stress test occurring based on historic evidence of wind patterns.

Question 5: Do you agree with how we have modelled demand curtailment in response to constrained supply?

We do not believe that the electricity demand curtailment assumptions used in the stress tests (and set out on page 99) fully reflect the growth of demand side response that we believe will arise over coming years. We believe that – particularly in the Green Transition and Green Stimulus scenarios – the introduction of smart meters in households will contribute to a step-change in the propensity of domestic customers to flex consumption to price signals. Although the exact impact of this change in behaviours is difficult to quantify, we believe this may lead to a material change in consumption patterns – most notably in the shifting of consumption away from peak periods, and an overall smoothing of domestic demand

It is also important to distinguish emergency curtailment (for example, interruption of I&C customers to preserve domestic supply) and normal demand side response. Further, when considering demand side response, it is also necessary to evaluate likely fuel switching capability (e.g. between gas and oil) and whether this will change.

Question 6: Do you have any other comments on our stress tests?

Other issues which it might be useful to consider are issues in related commodities/markets, for example: supply chain issues with wind turbines; ability to build new nuclear in the timescales if the IPC does not deliver; and customers/users failing to behave as predicted in response to incentives.

We also believe that it would be appropriate to consider the likely effects if sufficient investment in new gas storage does not eventuate under the current market arrangements. In particular how this might impact on the different green scenarios given the requirement for flexible (thermal) plant to support intermittent wind.

Section 3: Centrica questions arising from the consultation document, not otherwise covered

As stated earlier, Centrica believes it is important to have a range of scenarios, developed independently, to ensure any critical issues and / or sensitivities are identified. To this end, as you would expect we operate our own models and it would be useful to compare and contrast these in order to confirm whether we feel the Project Discovery modelling is, in our view, reasonable:

a) Is the investment return vs. risk assumed of 10% post tax right for all technologies?
b) What assumptions have been made on reduced consumption?
c) 2.14 implies the cost of carbon is affected by free allowances, is this intentional
d) The usage of a 1 in 20 cold winter (rather than the usual 1 in 50 severe winter) is unusual, what is the definition being used and what is it based on - e.g. last 50 years' data or last 20 years?
e) Is the level of voluntary gas curtailment in 05/06 considered likely to be repeatable in future?
f) How does the normal security of supply standard used in electricity convert to the measure of derated capacity margin?
g) What is the basis for the assumption of a wind capacity factor of 15%?
h) What level of RHI has been assumed in p/kWh or per therm? This is unclear on the face of the report, but appears to average £130-140 per customer in the appendix. What is the basis for the assumption and how have different technologies been accommodated?
i) The massive scale of the RHI assumption merits much more detailed exploration in the document rather than simply including in the appendix with no further explanation
j) What is the definition and assumptions underlying "low wind probability"?
k) Agreement is urgently needed on how to measure wind contribution to security of supply
l) Consideration should be given to the need for flexible plants (even peaking units) in the high wind scenarios
m) Centrica believes that the scenarios for power need to be extended further to at least 2030 when there may be greater stability in the nuclear and wind mix
n) The annual gas demand shown in the chart on page 8 appears inconsistent with the numbers shown on page 79.