Response to the Energy Review Consultation

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By

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Summary

With the UK becoming a net energy importer and with significant investments to be made over the next twenty years in generation capacity and networks, we feel the government should take further steps to develop the market framework for delivering IGCC (integrated gasification combined cycle) projects, which can provide reliable energy supplies. In particular, we draw to government attention the scope for indigenous production of synthesis gas (SG) and synthetic natural gas (SNG), which can substantially reduce UK dependence on gas imports for power generation and domestic heating. Waste/Biomass Co-gasification with coal is capable of securing, at a UK
strategic level, clean, affordable energy for the long term.

It is recommended that the UK government give consideration to the US approach (in particular loan guarantees) to stimulating and accelerating the commercial implementation of gasification technology in order that important national energy and environmental objectives can be met.

We note with concern the increasing dependence on gas imports and the issues of security of supply and potential balance of trade implications. Westfield in the past has produced 20% of the gas requirement of Scotland from indigenous sources (1961-1974). The proposed AFT-IGCC (advanced fuel technology integrated gasification combined cycle) programme for Westfield will produce in excess of 520MW and is capable of replication throughout the UK. Per DTI sources, UK potential for waste/biomass co-gasification with coal is 6GWe. Potential for coal only gasification is many times this level.

Overview

Until now much of the debate on our energy strategy has focused on Windpower, Wave and Tidal generation, and the pros and cons of Nuclear power. Many would acknowledge that we need all of these and our future energy strategy should be based on a balanced approach that avoids becoming overly dependent on a single technology. We also need to ensure Britain does not become over-dependent on imported energy.

The Government of the United States has recognised the strategic importance of maintaining energy-independence and is investing heavily in “clean-coal” technology.

Gasification of coal has come a long way since the era of the local gasworks. It is now a very clean and efficient process and when combined with IGCC (Integrated Gasification Combined Cycle) technology it is the cleanest and most cost effective way of generating electricity from coal.

At Westfield we plan to take this process a stage further. Instead of using coal as the sole feedstock, we propose a large-scale gasification process based on a hybrid fuel that is two-thirds waste material and one-third coal. This process has the potential to generate “green” electricity on the same scale as a nuclear power station, at a fraction of the cost, and without the attendant risks associated with nuclear waste. At the same time, it helps achieve several environmental objectives such as diverting waste from landfill and finding a secure and beneficial use for sewage sludge, converting waste into energy in a clean, emissions free process. Significantly, like nuclear power, this is a large scale base-load generator, which complements alternative intermittent sources such as wind and wave generation.

We believe this project has national significance. The technology could be applied on a wide scale, and could be retrofitted to many existing power stations. If adopted on a large scale it would reduce our need to import energy and ensure greater security of supply, it could also mitigate the need for developing new nuclear capacity with the associated risks, costs, and political ramifications. We hope the UK Government will give serious consideration to making this gasification technology a significant part of the UK’s energy policy. We recommend that Government give serious consideration to the US approach (in particular their loan guarantee scheme) as a means of stimulating and accelerating the commercial implementation of gasification technology in order that important national energy and environmental objectives can be met.

Background

Between 1961 and 1974 Westfield produced 20% of Scotland’s gas, from coal, using 4 Lurgi gasifiers, and coal from the Westfield opencast site. In 13 years operation the plant produced an uninterrupted supply to the Scottish gas supergrid.
With the introduction of North Sea Gas the plant ceased commercial production in 1974 and became the Westfield Development Centre for British Gas. Westfield was a key part of the British Gas gasification programme, which was designed to “prove” the commercial viability of large-scale commercial production of synthetic natural gas and to provide security of supply of gas for the United Kingdom when North Sea reserves eventually depleted. Following extensive trials and an investment of circa £1BN in today’s terms, the technology was deemed to be viable and the programme pronounced a resounding success in 1991.

As a result of significant reductions in UK energy prices in the 1990s the gasifiers on the Westfield site were de-commissioned and have remained in stasis since 1992 awaiting the inevitable upturn, which has now come about.

Global Energy acquired the Westfield Development Centre from British Gas in 1992 and built a 120MW Combined Cycle Gas turbine (now owned and operated by Scottish and Southern Energy).

Following the increase in natural gas prices it is planned to refurbish the site with the aim of utilising existing gasification assets, the introduction of briquetting technology which incorporates the combination of sewage sludge powder and or refuse derived fuel (RDF) along with coal as the fuel feedstock. It is proposed that the existing 120MW gas turbine, which is currently fuelled with natural gas, be switched to run on synthetic gas. This novel use of advanced fuel technology (AFT) will create an environmentally friendly, integrated gasification combined cycle (AFT - IGCC) power plant.

Looking further ahead the expansion programme will encompass the current planning consents for a 400MW power plant and will make Westfield a global model for large scale AFT-IGCC energy production.

Combining AFT with IGCC creates a system, which is:

CLEAN

Unlike waste incinerators and conventional coal fired power plants, the facility will have no primary stacks, and be capable of exceeding the most stringent environmental regulations. Tests show that no detectable dioxins or furans are produced in the gasification process and, furthermore, the closed system prevents an atmospheric release.

Unlike conventional incinerators, the gasifier does not produce an ash, which can leach hazardous materials. The high temperature unit melts the ash into a liquid slag, which is then cooled to form an inert, non-leachable vitreous (glassy) frit.

The technology is also highly compatible with recycling efforts. Sorting of municipal solid waste to recycle glass, metals and other inorganic materials is an integral part of the process. The vitreous frit can be sold as a road building aggregate. Nothing is wasted.

EFFICIENT

The gasification process has an energy conversion efficiency of up to 92% , significantly greater than incineration. In addition, the resulting medium-Btu product gas is an ideal fuel for a combined cycle power plant, which itself has up to 50% higher conversion efficiencies than a conventional steam-driven central power station.

The end vision for the project is the creation of an AFT-IGCC facility at Westfield producing 520MW of electrical power and the injection of any surplus gas into the National Gas Transmission system, which runs through the Westfield site.
AFT-IGCC technology is eminently suitable for the retrofitting of existing gas turbines and will provide affordable UK gas, produced from an indigenous, renewable source for the generation of electricity. It will avoid the security of supply risks and risks to our balance of payments that are inherent from importing large amounts of gas for power generation from unstable and remote parts of the world.

Appendix 1 shows a simplified schematic of the fuel options, the central gasification process and the product options. While it is the intention at Westfield to produce predominantly electrical energy, and synthetic natural gas, the process can also make hydrogen and transportation fuel.

Scale

In the UK approximately 330 million tonnes of waste is produced per year of which 30 million is municipal solid waste (MSW). Currently only about 9% of MSW is used for power generation. The potential electricity generation from all MSW in the UK is significant, 6GWe at 100% load factor. (Source: Waste/Biomass Co-Gasification with Coal, DTI technology Status Report 017)

Estimated established UK coal reserves amount to 222m tonnes, with a further known potential of 380m tonnes (Coal Authority May 2002). By utilising gasification technology these coal reserves represent approximately 2225 Billion Cubic Meters of Gas or the potential to extend indigenous gas supplies by approximately 22 years at 2005/6 consumption.

Benefits of AFT-IGCC Technology

Combines the use of a reliable coal supply with gate-fee waste and biomass qualifying for Renewable Obligation and Climate Change benefits.

Allows for economies of scale from larger plant than could be supplied just with waste and biomass.

Capable of achieving high environmental standards on all fuel sources.

Flexible choice of product options: gas, electricity, transportation fuel, and hydrogen.

Potential to extend viable economic life of existing CCGT power plant by retrofitting with gasification technology.

Energy Transmission

Waste/biomass co-gasification with coal and the production of synthetic natural gas (SNG) provides a route for “renewable” energy to be transported via the gas transmission network rather than the electricity transmission system. For example SNG produced at Westfield could be exported via the gas transmission network and used to generate electrical power in the South East of England in a standard combined cycle turbine.

Fit with Government Policy

Renewable Energy Supply
Westfield and AFT-IGCC technology can make a major contribution to the Scottish 2020, 40% renewable energy target, 20% of the target is quite feasible. The technology is a base load process, which compliments other renewable energy sources such as wind and hydropower.

**Meeting Environmental Targets**

It is important to note that gasification is fundamentally different from incineration: the process is ultra clean and there are no stack emissions.

The Westfield Project can solve the Scottish Sewage disposal problem. It can also provide a cost effective means of meeting Scottish biodegradable waste diversion targets, a problem that could cost the Scottish taxpayer hundreds of millions of pounds in penalties, tax and operating costs per year if not resolved.

**Climate Change**

This process can make a significant reduction in CO₂ equivalent emissions. Sewage sludge and biomass if spread on fields or placed in landfill will generate CH₄, (methane), which will be released to atmosphere. CH₄ is a greenhouse gas with a warming effect 23 times that of CO₂. By preventing the free release of CH₄ from sewage sludge and waste biomass, the Westfield Project could **save** in excess of 63 million tonnes of CO₂ equivalent, over the project life of 20 years (roughly 3 million tonnes a year, or over 1 million tonnes of carbon a year).

The significant scale of this potential contribution to tackling climate change is immediately apparent when it is compared to the figures in the Scottish Executive’s revised Climate Change Programme (published on 31 March) of an equitable Scottish Share of the UK carbon reduction targets of 1.7 million tonnes of carbon a year, and the Executive’s aspiration to exceed this by 1 million tonnes of carbon a year by 2010.

Synthesis gas (SG) is approximately 30% hydrogen; when hydrogen is converted into electrical power in a turbine it produces water not CO₂.

**Job Creation and Protection**

There will be substantial scope for job creation from:

- Construction Jobs
- Heavy Engineering
- Waste Processing
- Gas Production
- Coal Production
- Local Contractors and Services

The Westfield Project will create and protect hundreds of jobs. Once the process is rolled out over the UK, job creation and protection will be measured in thousands.

**Security of Energy Supply**

The UK is now a net importer of natural gas, 40% of our electricity is generated from gas and much of the imported energy is coming from unstable parts of the world. This process can mitigate the
security of supply problem by making gas in the UK from indigenous material. For comparison when rolled out over the UK a potential of 6GWe (per Dti) is equivalent to 4.8 Torness sized nuclear stations.

**Energy Diversity**

This is a base load renewable energy source; it will compliment wind and hydropower.

**Balance of Payments**

Gas is getting more expensive. Imports of large quantities of expensive natural gas are bound to adversely impact on our balance of payments position. Gasification of indigenous waste and coal will reduce this problem.

**Responses to key review questions**

Q2 “With the UK becoming a net energy importer and with big investments to be made over the next twenty years in generation capacity and networks, what further steps, if any, should the government take to develop our market framework for delivering reliable energy supplies?”

On August 8, 2005 President Bush signed the Energy Policy Act of 2005 into law. The Act contains significant incentives to support gasification technology research and development and to accelerate commercial deployment of gasification technologies for both power generation and industrial use. The primary incentives include cost share programs (up to 50% direct grants), investment tax credits (20% of project cost), and federal loan guarantees (up to 80% of project costs) that in some cases (specifically tax credits and loan guarantees) can be used in combination.

The incentives in the Act have the potential to make production of synthesis gas (SG) very competitive with natural gas for industrial uses and to enable integrated gasification combined cycle (IGCC) power plants to produce electricity at very competitive prices. These incentives, most of which will be available for a limited number of initial projects offer the potential for early adopters of commercial gasification technology to realise economic benefits while advancing important national energy and environmental objectives.

In the US context, for loan guarantees, the funding that must be appropriated is that which is needed to “score” the guarantees, which is the amount determined by the Office of Management and Budget based on the risk and amount of principle guaranteed. Essentially, budget dollars have to be appropriated to cover the expected default risk of the guarantee only.

It is recommended that the UK government give consideration to the US approach (in particular loan guarantees) to stimulating and accelerating the commercial implementation of gasification technology.

Q2 “In particular, we invite views on the implications of increased dependence on gas imports”.

We note with concern the increasing dependence on gas imports and the issues of security of supply and potential balance of trade implications. As has been stated above Westfield in the past has produced 20% of the gas requirement of Scotland from indigenous sources. The proposed AFT-IGCC programme for Westfield will produce in excess of 520MW and is capable of replication throughout the UK.
Appendix 2

Aerial view of part of the Fife Environmental Energy Park at Westfield: