

**25 November 2014**

**Underground Coal Gasification  
(UCG) - Overview**

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**Joint report of Assistant Chief Executive and Corporate Director  
of Regeneration and Economic Development**

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**Purpose of the Report**

1. The purpose of this report is to provide members of the committee with background information prior to presentations focusing on Underground Coal Gasification (UCG).

**Introduction**

2. When considering items for inclusion in the work programme of the Environment and Sustainable Communities Overview and Scrutiny for 2014/15 requests were made by members for the inclusion of an overview presentation on UCG. Arrangements have therefore been made for two presentations:
  - Jon Gluyas, Chair of Geo-energy, Carbon Capture and Storage at Durham University will provide a presentation which provides an overview of UCG; and
  - Jason McKewon, Senior Policy Officer, Regeneration and Economic Development will provide a presentation which will outline how the emerging statutory development plan for County Durham is intending to address UCG.

**Underground Coal Gasification**

3. UCG is a technological process involving the controlled combustion of coal seams beneath the ground and the consequent recovery of gases. It is achieved by carefully controlled directional drilling of a minimum of two wells from the surface. An access well to inject steam and air or oxygen to trigger and maintain the combustion of the seam, a production well which recovers the resulting gas-water vapour mixture to the surface for treatment. In addition sometimes a separate ignition well is drilled, through which a small amount of gas is injected to initiate combustion.
4. The combustible gas known as 'syngas' consists of hydrogen, carbon monoxide, carbon dioxide and methane. It can be used to feed a gas turbine power plant directly. Alternatively, steam treatment in the presence of a catalyst can convert carbon monoxide into carbon dioxide, releasing additional hydrogen to be used in power generation while the carbon dioxide is removed for storage. In certain circumstances the syngas can also be converted into diesel. Beyond energy applications syngas can be used for the production of methanol, ammonia and their derivatives.
5. The surface installation above the coal seam are understood to cover one acre and would consist of some temporary water and gas storage equipment and the drilling rigs themselves, all of which are removed when the coal seam is exhausted. Pipelines would also potentially be required for onward transmission to the power station or other

point of use. The typical life of a UCG production station might be 5 years, however, this will depend on the size of the resource.

## **Origins and recent developments**

6. The concept of UCG goes back to 1868 and William Siemens (founder of the modern engineering giant) who published the first paper proposing UCG. However, as a technology the UK was the originator, Sir William Ramsay conducted exploratory experiments beneath Hett Hill in County Durham in 1912. More recently, UCG has a history of development around the world in countries as diverse as the United States, France, Belgium, UK and in particular the former Soviet Union.
7. The basic feasibility of UCG has been proven in initial trials. In particular, an EU trial, sponsored in part by the UK's Department of Trade and Industry (DTI), has demonstrated the feasibility of UCG at depths typical of European coal. The DTI concluded that the UCG process has potential for UK coal reserves, particularly when considering the large quantities of offshore coal potentially available. More recent trials have taken place in the US and in Spain however the most advanced developments of UCG are now in Queensland Australia. Very few UCG plants have been built worldwide and none in the UK to date.
8. The UK Government believes that the UK is well placed within Europe in having large reserves of indigenous coal both onshore and offshore in the North Sea. These reserves have the potential to provide security of future energy supplies long after oil and natural gas are exhausted. It is, however, very difficult to put a figure on the reserves on the quantity of coal which would be available for UCG. While the Department of Trade and Industry have previously estimated that UK coal resources suitable for deep seam UCG on land are estimated at 17 billion tonnes, with a further 50 billion tonnes off shore it is now believed that offshore coal reserves are likely to be significantly higher. Published articles in local newspapers have reported the possibility of trillions of tonnes of coal being potentially available.

## **Licenses and other permits**

9. There are over twenty conditional licences currently granted in the UK (see map in Appendix 2). Within North East England there are eight offshore conditional licences. All eight were issued for a period of three years within which the licensee is required to move towards de-conditioning the licences and as part of this work the licence areas are expected to be refined to smaller areas. Six of the licences were issued to a Newcastle based company called Five Quarter, four were issued on 25 March 2011 off Lynemouth, Longhoughton, Blyth and Tynemouth, and two were issued on 16 December 2013 off Tynemouth and Sunderland. Two of the more recent licenses were issued to Cluff Natural Resources on 29 August 2014. Both of these licences are located off the Durham Coast and are known as Durham North and Durham South. Due to a lack of progress to decondition the four licences granted in 2011, Five Quarter has now applied to extend the term of these licences by a further three years.

## **Regulation**

10. UCG will be a heavily regulated industry. Licenses for UCG are issued by the Coal Authority. Following discussions with the Coal Authority they have now agreed in the

future to notify the Council of all licence applications and the issue of conditional licenses. However, this would not be a consultation exercise.

11. The issue of a conditional licence by the Coal Authority is the first step in a long process towards commercial production. No operations can take place until the licensee has de-conditioned the license and gained a wide range of other necessary permissions, consents and rights. This process also involves extensive exploration and appraisal work including the preparation of a wide range of environmental information necessary to secure the necessary, permissions and consents. For example, planning permission would be required from the relevant local planning authority for any land based facilities and infrastructure. Environmental permits would be required from the Environment Agency and other consents would be required from the Health and Safety Executive and potentially Natural England if designated sites or protected species were potentially affected. Offshore UCG operations would also require consents and rights to be gained from the Marine Management Organisation and the Crown Estate.

### **Potential Benefits/Impacts**

12. UCG has the potential to provide a wide range of benefits. It could enable access to deep off shore coal reserves which otherwise could not be exploited by conventional deep mined methods. Compared to conventional coal-fired power, UCG could greatly reduce the impacts associated with coal mining and the burning of coal in conventional coal fired power stations such as emissions of sulphur dioxide and nitrous oxides (responsible for acid rain and smog). UCG would also help reduce reliance on the import of fossil fuels thereby ensuring security and diversity of energy supply whilst helping to address the UK's balance of payments deficit.
13. A new underground coal gasification industry also could have significant economic benefits locally through the creation of direct employment in the UCG industry itself, together with further employment in a supply chain extending into UK Industry with a potential for technology export to a global market. Within the North East it was reported in 2014, that one of the licensees, Five Quarter believe that there is potential to generate over 400 new permanent jobs in the North East over the next five years, as well as a further 300 jobs during the development of a new £500 million 1 GW Power Plant (sufficient to provide power for 500,000 homes) and a £500 million gas processing plant in either Northumberland or Teesside which will process the syngas into a feedstock for the regions chemical industries.
14. Like all extractive industries the development of UCG has the potential to give rise to a wide range of adverse environmental impacts upon both the natural and built environment and the amenity of local communities which would need to be carefully considered as part of the regulatory processes. Potential impacts depend on the nature and location of any proposed development and could be numerous. Potential impacts on the natural environment could include air pollution, water pollution which could impact on coastal, surface and groundwater resources, visual and landscape impacts, impacts upon biodiversity, traffic and transport impacts including the impact of pipelines. UCG could also produce toxic waste which would require waste disposal.

### **Durham County Council's approach to UCG**

15. The Council intends to comprehensively address all conventional and unconventional hydrocarbons including UCG within the Minerals and Waste Policies and Allocations

Document. The preparation of this document will follow on from the adoption of the County Durham Plan in 2015. It is intended that the Minerals and Waste Policies and Allocations Document will be adopted by the end of 2016.

16. In the interim should a planning application be submitted which requires the development of land in County Durham for UCG including any associated infrastructure the Council can rely upon the provisions of the emerging County Durham Plan which will be adopted in 2015 and remaining saved policies of the County Durham Minerals Local Plan together with guidance in the National Planning Policy Framework (March 2013) and Planning Practice Guide (March 2014). It is a possibility that surface facilities for any sub-sea operations would need to be developed at or very close to the coast. Accordingly, given the location of the Durham North and Durham South conditional licences, key issues which will need to be carefully considered include impacts on the County Durham Heritage Coast and international and national nature conservation designations along the coast.

### **Recommendations**

17. That the members of the Environment and Sustainable Communities Overview and Scrutiny Committee note and comment upon the information provided during the presentations.

18. That the Environment and Sustainable Communities Overview and Scrutiny Committee receive a further update in relation to UCG at a future meeting of the committee.

### **Background papers**

Briefing note on UCG from the Alliance Secretariat

Briefing note by DCC

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## **Appendix 1: Implications**

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**Finance** –None

**Staffing** – None

**Risk** - None

**Equality and Diversity** – None

**Accommodation** - None

**Crime and Disorder** - None

**Human Rights** - None

**Consultation** – None

**Procurement** - None

**Disability Discrimination Act** – None

**Legal Implications** – None

## Appendix 2: Map showing the location Underground Coal Gasification Licences

