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**Submitted Via Email**

Electricity Market Reform Project  
Department of Energy & Climate Change  
4<sup>th</sup> Floor Area E  
3 Whitehall Place  
London  
SW1A 2AW

**Re: Consultation on Electricity Market Reform**

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On behalf of our client Peabody Energy (“Peabody”), Mowrey Meezan Coddington Cloud LLP welcomes the opportunity to provide these comments on the December 2010 “Consultation on Electricity Market Reform” (hereinafter “Consultation”).<sup>1</sup>

**Background**

The Consultation sets forth a series of options for reform of the electricity market to “ensure that low-carbon technologies become a more attractive choice for investors, and adequately reward back up capacity to ensure that the lights stay on.”<sup>2</sup>

The Consultation includes proposals in four areas: (1) carbon price support; (2) feed-in tariffs; (3) capacity payments; and (4) emissions performance standard (EPS). The first proposal – carbon price support -- is the topic of a separate consultation, in which Peabody separately filed comments.

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<sup>1</sup> <http://www.decc.gov.uk/assets/decc/Consultations/emr/1041-electricity-market-reform-condoc.pdf>.

<sup>2</sup> Consultation, at p. 5.

**Comments: Advanced Coal-Fueled Power Must Be An Integral Component of the UK's Future Electricity Markets**

The Consultation's premise – namely, that coal without carbon capture & storage (CCS) should not be a part of the UK's future electricity markets – is false. It is false because it rests upon erroneous assumptions about coal's unique abilities to deliver low-cost, reliable, and clean power. As a result, under all scenarios, the UK should encourage the use of advanced coal-based technologies while achieving the UK's environmental and energy security goals.

**a. Only Coal Can Meet the UK's Energy Reliability, Security and Related Electricity Needs**

**Abundance and accessibility** – Coal is the world's most prevalent and widely distributed fossil fuel, accounting for 64% of global economically recoverable fossil resources compared to 19% for oil and 17% for natural gas. The amount of proven recoverable coal reserves is enormous and exceeds a trillion tonnes. Coal is distributed across every continent and every region of the world. The Western Hemisphere itself has over 300 billion tons of coal, Europe has 73 billion and Australia over 75 billion.

**Secure energy** – The global distribution of the coal provides energy security across broad political arenas. As the IEA (2007) has noted: "It is widely acknowledged that the oil and natural gas markets provide risks that undermine security of supply." While 2% of the world's population controls 52% of the oil and 3% of the population controls 54% of the natural gas, 42% of the global population controls 50% of the coal (BP, 2010).

**Reliability** – Coal's abundance and distribution, coupled with its relatively low end stable price pattern, set the stage for a reliable supply of energy. Coal-based generation is one of the first sources to be dispatched throughout the electric grid. Coal's reliability characteristics make it a very attractive baseload fuel. Consistently, the amount of electricity generated from coal significantly exceeds coal's relative capacity compared to other fuels. In 2008, for instance, coal accounted for only 31% of total generation capacity but produced 41% of the world's electricity.

**Affordability** – Over the last decade the price of coal to produce electricity has been significantly lower and less volatile than natural gas or oil prices. In the United States, for example, the cost of gas to produce electricity has ranged from \$3.80 to \$11.51 per million British thermal units (BTU). The cost of coal has never exceeded \$2.27 per million BTU. Affordability and price stability are also the reasons developing nations are turning to coal-based generation. China, for example, is projected to build between 500 and 1,000 GW of new coal capacity over the next 25 years. Based on IEA analyses of levelized costs of electricity,

supercritical coal plants are one of the most affordable sources of power generation in China, \$33 per MWh compared to \$50 for hydro, \$53 for nuclear and \$71 for wind (IEA, 2010c).

**Versatility** – Countries around the world have been initiating an increasing number of coal conversion projects, ranging from coal-to-liquids to coal to substitute natural gas to coal to chemicals. The scale of China’s coal conversion plans is especially informative and indicates that the goal is to develop an additional 1.2 billion tonnes of coal over the next decade and to utilize that coal in various conversion projects (Jiachun, 2010). Further, coal to liquids will gain increasing importance with the approach of global peak oil production.

#### **b. Coal Meets the UK’s Environmental Goals**

Modern technology ensures that coal usage brings with it improved air quality. Table 1 below shows coal consumption for electricity generation in the UK:

<b>Coal Consumption in Electricity, UK, 2000 to 2008<sup>3</sup></b>	
<b>Year</b>	<b>Consumption in million tonnes</b>
2000	46
2001	51
2002	48
2003	53
2004	50
2005	53
2006	57
2007	53
2008	48

*Table 1: Coal Consumption in Electricity, UK, 2000 to 2008*

Table 1 suggests that coal usage in the UK has roughly hovered around 51 million tonnes per year over the past decade. The most recent data from 3Q 2010 indicate that coal consumption is trending back up from 2009.<sup>4</sup>

<sup>3</sup> Source: *Historical Coal Data: Coal Availability and Consumption, 1853 to 2000*, UK Department of Energy & Climate Change (downloaded from <http://www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx>).

<sup>4</sup> *Energy Trends* (Department of Energy & Climate Change, Dec. 2010) (available at <http://www.decc.gov.uk/assets/decc/Statistics/publications/energytrends/1082-trendsdec10.pdf>).

Data from the European Environmental Agency confirm that over the same period UK air quality has improved – and in most instances, 2010 goals were met years in advance.<sup>5</sup>

Figure 1 below shows the dramatic improvement in UK NO<sub>x</sub> emissions, 2000 to 2008, and projections through 2020.

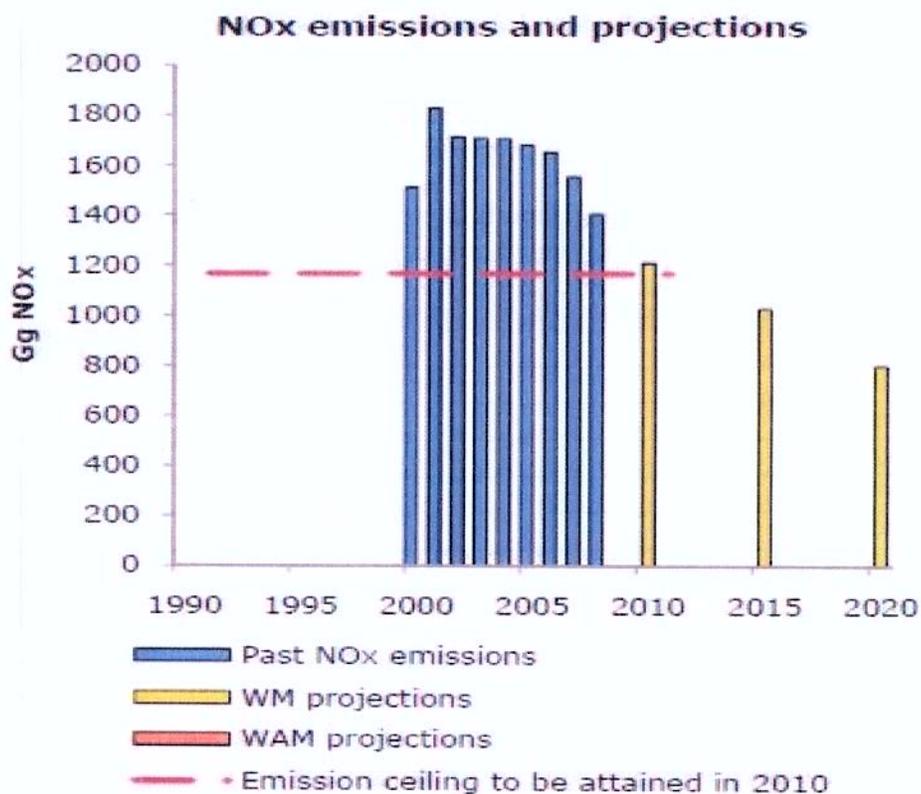


Figure 1: UK NO<sub>x</sub> Emissions and Projections

Figure 2 below shows the dramatic improvement in UK NMVOC emissions, 2000 to 2008, and projections through 2020.

<sup>5</sup> Figures 9-12 which follow are taken from the European Environment Agency's UK Air Pollutant Emissions Country Factsheet (downloaded from <http://www.eea.europa.eu/themes/air/air-pollutant-emissions-country-factsheets/united-kingdom-air-pollutant-emissions/view>).

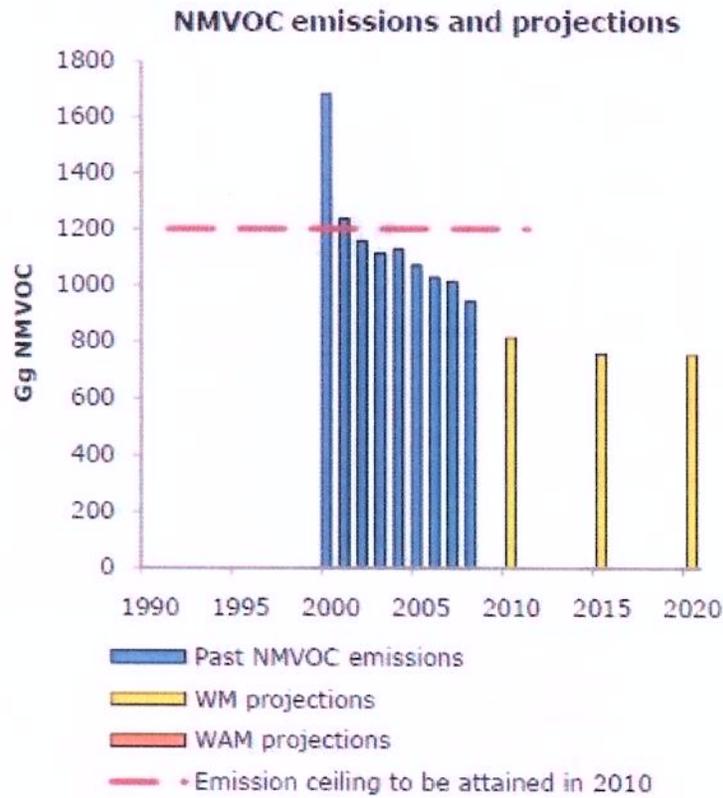


Figure 2: UK NMVOC Emissions and Projections

Figure 3 below shows the dramatic improvement in UK SO<sub>2</sub> emissions, 2000 to 2008, and projections through 2020.

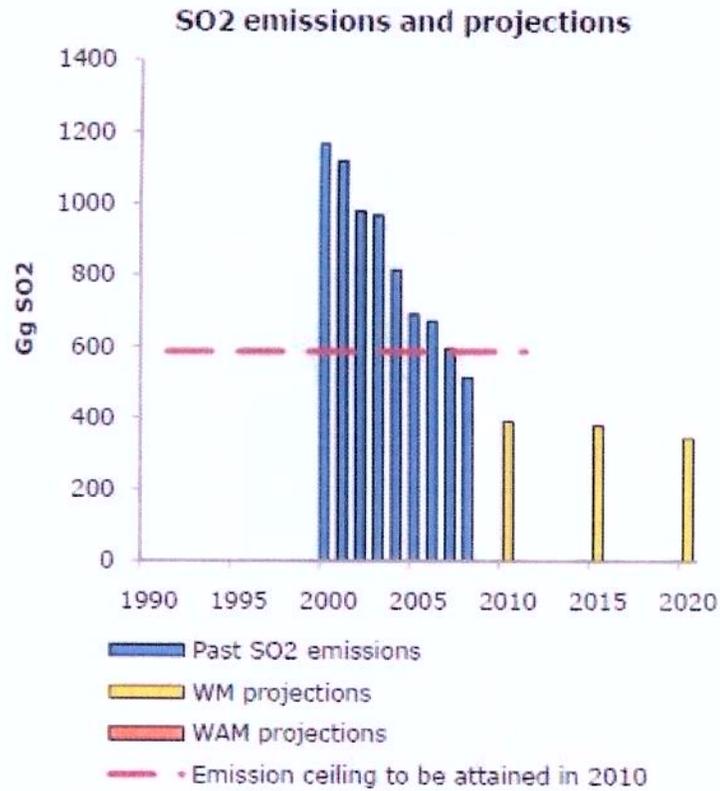


Figure 3: UK SO<sub>2</sub> Emissions and Projections

Figure 4 below shows the dramatic improvement in UK NH<sub>3</sub> emissions, 2000 to 2008, and projections through 2020.

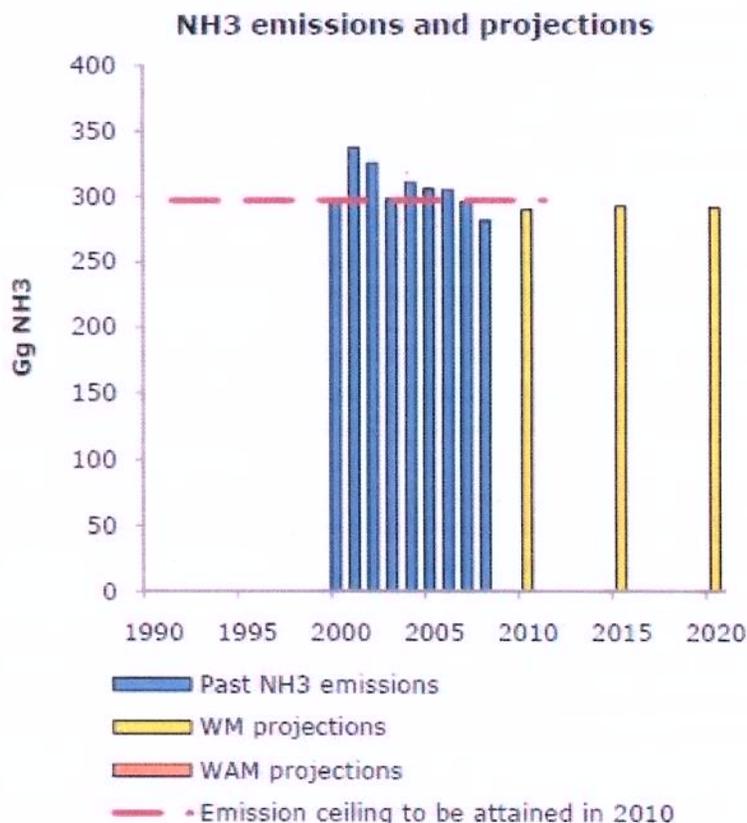


Figure 4: UK NH<sub>3</sub> Emissions and Projections

With respect to emissions of greenhouse gases (GHG), a growing number of studies, reports and articles is documenting that natural gas, on a GHG lifecycle basis, has higher emissions than coal. This is particularly the case for natural gas produced from unconventional sources – i.e., shale gas.

A starting point is the recent report by the Tyndall<sup>6</sup> Centre for Climate Change Research, which found<sup>6</sup>:

<sup>6</sup> “Shale Gas: A Provisional Assessment of Climate Change and Environmental Impacts,” Tyndall<sup>6</sup> Centre for Climate Change Research, at p. 5 (UK, Jan 2011). The Tyndall<sup>6</sup> Centre has submitted similar information to the Energy and Climate Change Committee:  
<http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/writev/shale/sg12.htm>. Note that prior

It is clear, however, that ... shale gas extraction ... does pose significant potential risks to human health and the environment. Principally, the potential for hazardous chemicals to enter groundwater via the extraction process must be subject to more thorough research prior to any expansion of the industry being considered. Additionally, while being promoted as a transition route to a low carbon future, none of the available evidence indicates that this is likely to be the case.

The Tyndall<sup>o</sup> Centre report is buttressed by comparable research in the United States. A 2010 study by a professor at Cornell University concluded<sup>7</sup>:

- ✓ “Natural gas is being widely advertised and promoted as a clean burning fuel that produces less greenhouse emissions than coal . . . society should be wary of claims that natural gas is a desirable fuel in terms of the consequences of global warming.”
- ✓ “Comparing the total emissions of greenhouse gas emissions from [hydraulic fractured] natural gas suggests that they are 2.4-fold greater than are the emissions just from the combustion of the natural gas.”
- ✓ “The leakage of methane gas during production, transport, processing, and use of natural gas is probably a far more important consideration . . . . Since methane is such a powerful greenhouse gas even small leakages of natural gas to the atmosphere have very large consequences on global warming.”

A 2009 study by Southern Methodist University predicted 2009 emissions of GHGs from production activities in the Barnett Shale of Texas to be 33,000 tons per day of carbon dioxide equivalent, an amount that the researchers concluded was roughly equivalent to the expected GHG impacts from two 750 MW coal-fired power plants.<sup>8</sup>

Researchers at the University of Wisconsin-Madison made the same point back in 2005:

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European papers on lifecycle GHG emissions from natural gas did not examine unconventional gas operations, so tend to underestimate current GHG emissions from that industry. R. Dones et al, “Life Cycle Inventories for the Nuclear and Natural Gas Energy Systems, and Examples of Uncertainty Analysis,” *Int. J. LCA* 10(1) 10-23 (2005) (noting fugitive methane emissions from upstream conventional natural gas production and pipeline transportation).

<sup>7</sup> See R. Hayworth, “Preliminary Assessment of the Greenhouse Gas Emissions from Natural Gas Obtained by Hydraulic Fracturing” (Cornell University, 2010).

<sup>8</sup> See A. Armendariz, “Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements” (Southern Methodist University, 2009).

Due to the recent growth in combined-cycle power plants, the role of natural gas fuel deserves critical evaluation. [Life cycle analysis] dramatically alters the environmental performance of this technology. The emission rate from plant fuel combustion alone increases 22% to 466 tonnes CO<sub>2</sub>-Eq./GWh, with full accounting of the system life-cycle. Most of this increase occurs due to fuel-cycle losses resulting from natural gas combustion and methane leaks ... An important question is whether increased natural gas reliance can provide sustainable compliance with greenhouse gas emission targets ... Neglecting life-cycle emissions, in particular from the natural gas fuel-cycle, is shown to lead to inaccurate assessment of policy alternatives.<sup>9</sup>

The 2010 Pulitzer Prize-winning journalists at ProPublica have launched an independent investigation of the alleged climate benefits of shale gas. In their most recent article, ProPublica notes that “new research by the [EPA] – and a growing understanding of the pollution associated with the full ‘life-cycle’ of gas production – is casting doubt on the assumption that gas offers a quick and easy solution to climate change.”<sup>10</sup>

In 2010, the National Research Council of the U.S. National Academy of Sciences concluded<sup>11</sup>:

The upstream life cycle of power generation from natural gas includes many relevant activities such as construction of the infrastructure and power plants, but the most significant from a perspective related to GHG emissions ... are the extraction and transportation of gas. These activities are generally fuel- and energy-intensive, requiring combustion of fossil fuels for drilling and removing the gas from underground and delivering to the power plant. Beyond emissions from engines, these are also significant GHG emissions of methane, which is from fugitive emissions of natural gas.

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<sup>9</sup> P. Meier, “US Electric Industry Response to Carbon Constraint: A Life-Cycle Assessment of Supply Side Alternatives,” *Energy Policy* 33 (2005) 1099-1108.

<sup>10</sup> <http://www.propublica.org/series/buried-secrets-gas-drillings-environmental-threat>. On January 31, 2011, members of the Energy and Commerce Committee in the U.S. House of Representatives released the results of their investigation into fracking practices by the oil & gas industry. The congressional investigation found that oil and gas service companies had injected over 32 million gallons of diesel fuel or hydraulic fracturing fluids containing diesel fuel in wells in 19 states between 2005 and 2009. In addition, the investigation found that no oil and gas service companies had sought – and no U.S. state and federal regulators had issued – permits for diesel fuel use in hydraulic fracturing, which appeared to be a violation of the U.S. Safe Drinking Water Act. <http://democrats.energycommerce.house.gov/index.php?q=news/waxman-markey-and-degette-investigation-finds-continued-use-of-diesel-in-hydraulic-fracturing-f>.

<sup>11</sup> “Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use,” p. 116 (National Research Council, 2010).

Of increasing relevance is the use of liquefied natural gas ... to generate power. Over the past decade, a global market has begun for the extraction of gas for export via liquefying it, shipping it by tanker (similar to petroleum), and regasification. Each of these stages increases the energy use and air emissions associated with the life cycle of the power generated.

Transportation of natural gas in the United States occurs via pipelines. While pipelines are a very cost- and energy-efficient transportation mode, they use significant amounts of fuels and electricity to move the gas from well to power plant. In addition, pipelines leak natural gas as methane into the air. ...

The Council of Scientific Society Presidents – representing the presidents, presidents-elect, and recent past presidents of approximately sixty scientific federations and societies whose combined membership numbers well over 1.4 million in over 150 scientific disciplines – sounded an identical cautionary note in 2010 about the GHG lifecycle emissions of shale gas<sup>12</sup>:

Some energy bridges that are currently encouraged in the transition away from GHG-emitting fossil energy systems have received inadequate scientific analysis before implementation, and these may have greater GHG emissions and environmental costs than often appreciated ... Prior, thorough science-based studies are required to evaluate the impact of massive shale development on ... full-life-cycle greenhouse emissions.

In its February 2011 “Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources,” the EPA stated<sup>13</sup>:

One of the largest potential sources of air emissions from hydraulic fracturing operations is the off-gassing of methane from flowback before the well is put into production. [State of New York environmental officials] estimated that 10,200 mcf of methane is off gassed per well (ICF International, 2009a). One study in the Barnett shale estimated that between 1,000 and 24,000 mcf of methane is released per well (Armendariz, 2009).

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<sup>12</sup> <http://www.eeb.cornell.edu/howarth/CCSP%20letter%20on%20energy%20&%20environment.pdf>.

<sup>13</sup> [http://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/D3483AB445AE61418525775900603E79/\\$File/Draft+Plan+to+Study+the+Potential+Impacts+of+Hydraulic+Fracturing+on+Drinking+Water+Resources-February+2011-Report.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/D3483AB445AE61418525775900603E79/$File/Draft+Plan+to+Study+the+Potential+Impacts+of+Hydraulic+Fracturing+on+Drinking+Water+Resources-February+2011-Report.pdf) (at p. 55).

On February 16, 2011, EPA released for public comment the US 16<sup>th</sup> Annual Greenhouse Gas Inventory. There, EPA tentatively determined that total methane emissions from natural gas systems increased between 47-120% each year between 1990 and 2008 relative to the previous report, with the increase largely due to “methodological changes to gas well cleanups and the addition of unconventional gas well completions and workovers.”<sup>14</sup>

The Parliament is taking up these issues, too. On February 9, 2011, the Energy and Climate Change Committee held its first evidence session on shale gas, to include topics such “How does the carbon footprint of shale gas compare to other fossil fuels?”<sup>15</sup> The studies referenced above offer an answer to that question.

### **c. Integration of Advanced Coal-Fueled Power into the UK’s Electricity Market Reforms**

Under all scenarios, to ensure that the social and environmental benefits identified above are obtained, the UK must ensure that advanced coal-fueled power plays an integral role in current and future electricity markets. By advanced coal-fueled power, we mean supercritical and ultra supercritical pulverized coal power plants. We also mean the eventual deployment of CCS technologies once that technology has been commercially demonstrated in electricity generation applications.

Increasing the efficiency of coal-fueled power plants by 1% leads to a reduction in CO<sub>2</sub> emissions of 2–3% (Beer,2009). Thus, advanced coal-fueled power plants without CCS already have CO<sub>2</sub> emissions up to 40% lower than the average for all coal plants. Ensuring that all new coal-fired plants are constructed using the most efficient technologies applicable to local conditions combined with the replacement of existing, highly inefficient coal-fueled plants can deliver significant global CO<sub>2</sub> reductions and reduce CO<sub>2</sub> emissions from coal by almost 25%. This would represent a 6% reduction in global CO<sub>2</sub> emissions.

Today’s best available technology allows efficiency up to 46% for hard coal plants and 43% for lignite fired plants (IEA, 2010a). In Europe, the current *Seventh Framework (FP7)* seeks to increase efficiency to over 50% through further research and development and better integration of components. In both Denmark and Japan, coal-fueled power generation is operated with a total efficiency rate of 40% or more, the highest national rates in the world (IEA, 2010a). In Germany there are 8,230 MW power capacity on the basis of hard coal with an efficiency rate of 46% under construction. Furthermore 2,760 MW of power capacity on the basis of lignite are

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<sup>14</sup> See Draft US GHG Inventory, at p. 3-47 (Feb. 2011).

<sup>15</sup> See <http://www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/news/sg1/>; Memorandum submitted by the World Coal Association (<http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/writev/shale/sg02.htm>).

under construction with an efficiency rate of more than 43%. Thus, a total of 11,000 MW highly efficient coal based power capacity is under construction to begin operation between 2011 and 2013.

It is also imperative that the UK continue its efforts to fund the demonstration of CCS technologies; to that end, we are pleased that the Coalition Agreement commits the Government to public sector investment in four CCS demonstration projects.

The UK's views on CCS put it in good company. In 2008, the IEA identified CCS for power generation as "the single most important new technology for CO<sub>2</sub> savings." In 2010, the IEA concluded that the high costs of alternative sources of electricity "demonstrate the importance of the availability of CCS as an option for mitigating CO<sub>2</sub> emissions." Researchers at the Massachusetts Institute of Technology (MIT, 2007) have stated CCS "is the critical enabling technology that would reduce CO<sub>2</sub> emissions significantly while also allowing coal to meet the world's pressing energy needs." The Clean Air Task Force (2009) has been even more direct: "No credible technical body has found that adequate CO<sub>2</sub> emissions reductions are possible without widespread use of CCS.

Given this widespread technical support for CCS, policy leaders around the world have stressed the importance of developing and implementing CCS programs. In June 2010, for example, the G8 summit concluded: "We encourage the IEA to develop work on an International Platform for low-carbon technologies, in order to accelerate their development and deployment. Carbon capture and storage ... can play an important role in transitioning to a low-carbon emitting economy."

#### **d. CCS Applies to Both Natural Gas and Coal**

Natural gas-fueled power plants are also going to have to deploy CCS to meet the UK's GHG reduction goals. CCS is not just about coal, particularly when the goal is an 80% reduction in GHG emissions. Natural gas-based electricity generation will also require CCS to meet such a reduction.<sup>16</sup>

Indeed, just last week, the UK published its updated 2050 Pathways Analysis. That updated analysis includes CCS on natural gas-based electricity generation.

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<sup>16</sup>"The Future of Natural Gas: An Interdisciplinary MIT Study, Interim Report," at p. xiii (Massachusetts Institute of Technology, 2010) ("A more stringent CO<sub>2</sub> reduction of, for example, 80% would probably require the complete decarbonization of the power sector").

The Consultation recognizes that CCS will have to be applied to natural gas to meet the UK's GHG reduction goals, but declines to implement that outcome<sup>P</sup> The reasons offered by the Government in excluding natural gas from what amounts to the proposed CCS mandate are spuri\_ous:

- ../ The Government erroneously states that its modeling suggests that natural gas will result in lower GHG emissions if for no other reason than fossil generation as a whole will be a lower percentage of the electricity generating mix. The Government's modeling is incorrect because it fails to consider lifecycle GHG emissions of natural gas. Natural gas usage means higher lifecycle GHG emissions than coal.
- ../ The Government asserts that subjecting natural gas to a CCS mandate would create investment uncertainty for that fuel. Yet by only subjecting coal to a CCS mandate, the Government will end up incentivizing the construction and operation of gas plants that have higher lifecycle GHG emissions than coal.

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Thank you again for the opportunity to provide these comments.

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<sup>17</sup> Consultation, at p. 74.

