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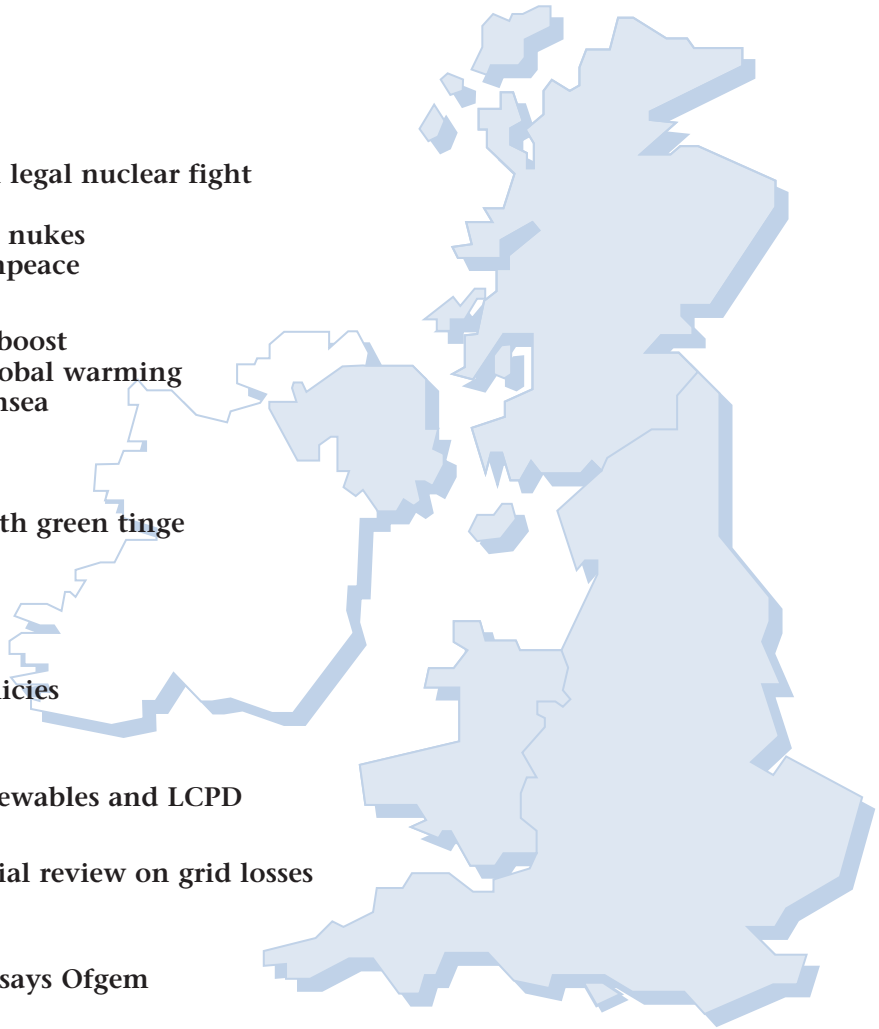
# Power UK





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# Coal's renaissance revisited

The future of the coal industry could not have looked rosier 18 months ago – the industry seemed to have withstood twin regulatory assaults from the Large Combustion Plant Directive and the EU Emission Trading Scheme, and despite increasing coal prices, coal generation was at a 10 year high, and there was significant investment planned at many of the major power stations. In the following article, **Michael Wagner*** examines how the prospects for coal generation have changed since then and asks whether the future still looks so rosy?

In May 2006, UK coal-fired power plant output was at a 10 year high (*see figure 1*) with the high level of gas prices making coal the more competitive generation fuel. However, over the last 18 months there has been significant price volatility, particularly in the gas and carbon markets, which has led to an ever changing picture in terms of coal's competitiveness (*see figure 2*). There has been some erosion of coal's competitive position, leading to a projected reduction in coal burn of over 10% in 2007, compared with the high level of coal running seen in 2006, although coal is still providing a significant contribution to the generation mix.

***The question is what will happen to the opted-out plant over the longer term?***

Despite the current spike in spot coal prices, the future economics of coal look promising, with the forward curve showing coal maintaining a competitive position along the curve (*see figure 3*), despite the sharp increase in carbon prices with the commencement of phase 2 of the EU Emissions Trading Scheme (ETS) in January 2008.

## Low, low sulfur

The Large Combustion Plants Directive (LCPD) places significant constraints on emissions from coal plant, and has sent coal plant owners scurrying to fit Flue Gas Desulfurization (FGD) to around 9 GW of plant, incentivized by a higher level of free carbon allowance granted under phase 2 of the EU ETS.

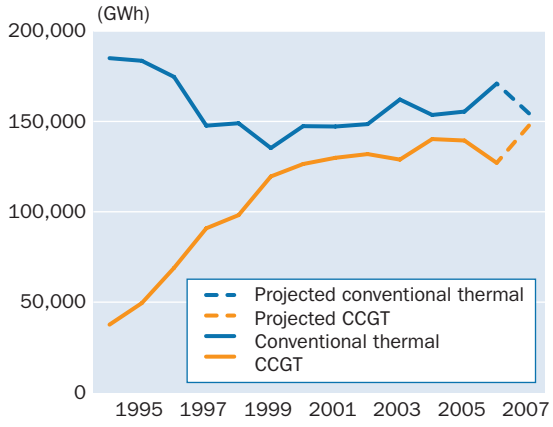
But many of these developments will not be completed by January 2008 when the LCPD kicks in, and industry players are keeping their cards close to their chests with respect to installation progress and their strategy in the interim. If these plant are not available to run, this could put significant pressures on system plant margins.

It seems plant may utilize a derogation from Emission Limit Values (ELVs). Peaking plant can run for 2,000 hours per year under relaxed ELVs of 800mg/Nm3 – which should be achievable on a 0.35% sulfur diet (similar to that currently being burned at Tilbury) – allowing them to continue limited operations until FGD is fitted.

Nevertheless, restricted coal running could lead to system stresses over the year, and it will be interesting to see the UK Government's approach if system security issues lead to power stations running outside environmental permit conditions.

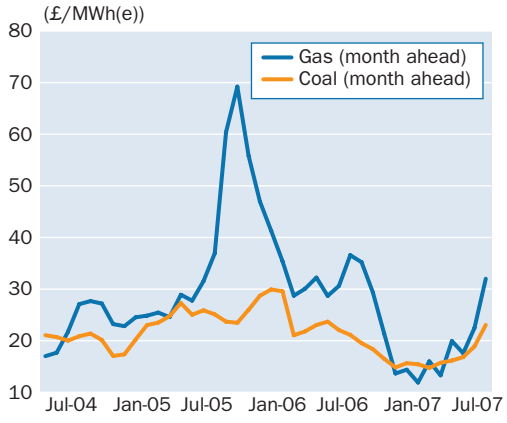
Some plant have opted-out of the LCPD, electing to use the limited hours derogation (where they may run to 20,000 hours and then close by 2016 – see Table 1).

**Fig 1. Coal and gas running**




Source: IPA/Elexon/DUKES

**Fig 2. Historic competitiveness of coal versus gas**




Source: IPA/Spectron

**Table 1. Coal plant sulfur emission limits**

| | Rate Limits | Mass Limits |
|---|---|---|
| Opted in ELV | 400mg$SO_2$/m . Based on load weighted average over 48 hours over all boilers. Excludes start up and shut down. | 9kt/year per GWe capacity Excludes start up and shut down. Transferable 'B' limits Limits FGD plant to 58% LF @ 1.75% sulfur coal with 90% sulfur removal. |
| Opted in NERP | 1.8tSO2/GWh Equivalent to 400mg$SO_2$/m Excludes start up and shut down. but this is an annual limit. | Annual NERP mass limit = LCPD opted-in ELV ×, average annual waste gas flow for 1996-2000 (estimated using fuel net calorific values), resulting in limits/unit capacity of between 5.5 and 8.5 kt/year per GWe (implying load factors of between 35% and 55% @ 1.75% sulfur coal with 90% sulfur removal). |
| Opted Out 20,000 hours operation over station between 2008-2015. Plant must then close. Limit plant to average 28% LF over period | 7.5t$SO_2$/GWh Equivalent to 2000mg$SO_2$/m , but this is an annual average. Excludes start up and shut down | 9kt/year per GWe capacity. Excludes start up and shut down. Transferable B limits. Limits non-FGD plant to 22% LF @ 0.6% sulfur coal. |

Source: IPA/EA

These plants also have relatively tight sulfur bubbles which restrict the annual level of emissions from the plant. However, traders have been very successful at reducing the sulfur content of coal supplies to these plants, falling from an average of 0.7% in 2002 to 0.43% in 2006 (*see figure 4*), allowing them to squeeze significantly more running out of their annual sulfur bubble.

The question is what will happen to the opted-out plant over the longer term?

***There is clearly significant potential to increase the level of co-firing beyond the levels seen in 2005***

In a world where there could be pressure on plant margins with nuclear retirement and increasing penetration of intermittent wind generation, flexible peaking plant might be just what the system needs, and the retirement of 9 GW of coal plant before 2016 might put significant additional pressures on system security. While there are plans for retro-fitting or rebuild at many of the opted out coal plant sites, realistically these will only come to pass if the project economics and the regulatory environment provide the right incentives.

However, the LCPD provides a derogation for peaking plant to run post 2016 for 1,500 hours per year with relaxed ELVs of 800mg/Nm3 – which should be achievable on a low sulfur diet for non-FGD plant. Whilst not strictly under the terms of the original opt-out from the LCPD, this could perhaps yet provide an ongoing regulatory framework and a lifeline to keep these coal plants operating.

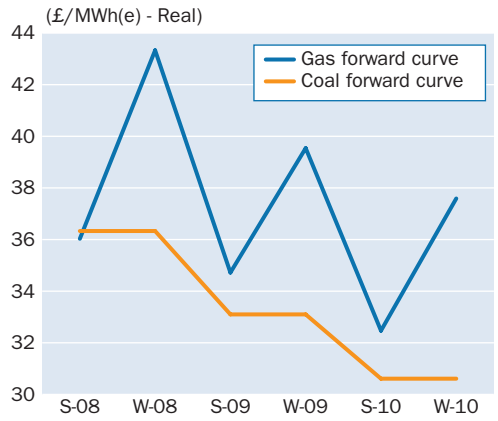
## Renewable coal

When first implemented, the Renewables Obligation allowed coal stations to earn Renewables Obligation Certificates (ROCs) by co-firing with biomass. This resulted in coal generators racing to obtain biomass fuels which could be relatively easily mixed with the coal feed, and saw the growth in imported bio-wastes such as olive pits and palm kernels. Co-firing grew rapidly to a point where it contributed around 18% of all ROCs surrendered (*see figure 5*), providing a significant fillip to coal station economics. However the imposition of a cap on co-firing in 2005 has served to restrict non-energy crop co-firing, with energy crop co-firing as yet to provide significant volumes due to restrictions on fuel availability.

There is clearly significant potential to increase the level of co-firing beyond the levels seen in 2005 – both through the development of energy crop fuels, as well as through investment in fuel handling and direct injection systems at plant. This could deliver lower emissions from the coal fleet. However, the UK Government has seemed cautious about its support for co-firing – both due to its implicit support for coal burn and arguably due to its current reliance on imported biomass fuels.

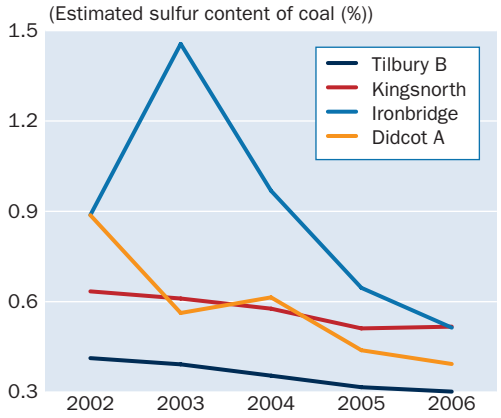
The current UK Government plan is to band co-firing with non-energy crops receiving 0.25 ROCs and energy crop fuels receiving 1 ROC. The non-energy crop banding seems relatively aggressive, and may well restrict co-firing to utilising only the cheapest biomass fuel sources. While there is significant development of energy crop cultivation with potentially around 2TWh(e) available by 2009, there is still relatively little experience of cultivation of the different crops and the development of a supply chain, so fuel availability is likely to remain the limiting factor.

## Fig 3. Future competitiveness of coal versus gas



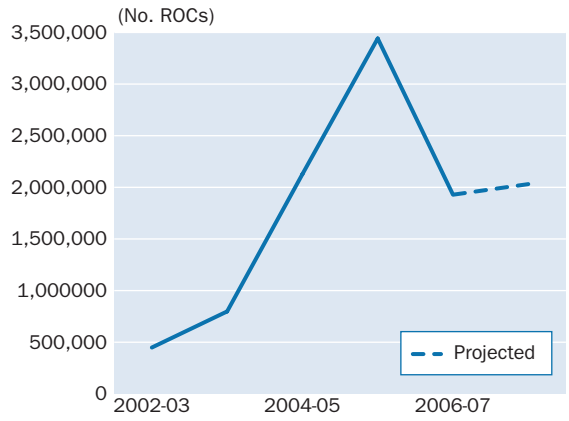

Source: IPA/Spectron

## Fig 4: Coal sulfur content at non-FGD plant




Source: IPA Analysis

## Fig 5. ROCs produced by co-firing at coal plant




Source: IPA/Ofgem

It looks as if co-firing is here to stay, and investment is going into a number of coal plants to increase their capability to handle and burn biomass fuels. Arguably banding proposals and the relatively low level of energy crop cultivation mean that the full potential of co-firing is unlikely to be realised, at least over the medium term, resulting in higher carbon emissions from coal plant – which will remain an important component of the generation mix for a while yet!

### Capture the carbon

Coal adds an important source of diversity to the generation mix both within the UK and across Europe, but has the downside of being one of the most carbon intense forms of generation. The increasing focus on reducing carbon emissions from the power sector and pricing emissions through the EU ETS could yet prove to be coal's nemesis. However, the possibility of using Carbon Capture and Storage (CCS) to turn coal into a low carbon intensity power generation source is one which is now receiving a significant amount of attention.

The UK Government has announced a competition to construct a post-combustion CCS plant to be operational by 2014, with the EU proposing to support development of 12 large scale CCS plant by 2015. In addition, there are EU proposals that all new coal plant should be fitted with CCS by 2020, and Prime Minister Gordon Brown recently reinforced this promising that "if we can show that carbon capture and storage is technologically and commercially viable, it should be made mandatory in some form for all new British fossil fuel plants."

***There are however still significant challenges ahead for CCS***

There are however still significant challenges ahead for CCS and progress has to be made in technical, economic, legal, regulatory and political arenas. So it is too soon to say whether CCS will be coal's saviour, or whether ultimately the focus on low carbon generation sources and a suggested EU regulation to limit CO2 emissions rates – with a timed phase-out of all non-CCS CO2 emitting generation by 2050 – will cause the slow lingering death of coal.

### Shiny new coal

There may be many uncertainties associated with the future development of coal, not least the continuing uncertainty surrounding the future of the EU ETS, and the issues of ever tightening emissions restrictions.

However, this has not stemmed a growing tide of new coal station developers, with around 14 GW at various stages of development (*see table 2*), the two most advanced projects arguably being Centrica/Progressive Energy at Teesside and E.on at Kingsnorth. But despite the current interest in new coal plant, and a number of ongoing FEED studies, we are still a distance away from a firm commitment to build new coal plant.

## Table 2: Coal fired generation projects

| Station Name | Developers | Size (MW) | Planned Date | Consent Status |
|---|---|---|---|---|
| **Ferrybridge** | SSE | 500 | 2014 | Not Applied |
| Retrofit plans scrapped in favour of new supercritical on site of existing station. | | | | |
| **Tilbury** | RWE | 1,200 | 2013 | Not Applied |
| Retrofit of a supercritical plant. RWE have submitted an environmental scoping document. Designed to include CCS technology. | | | | |
| **Kingsnorth** | E.ON | 1,600 | 2012 | Applied |
| Section 36 application submitted for new build supercritical replacing existing station, but reusing some infrastructure. | | | | |
| **Killingholme** | E.ON | 450 | 2012 | Not Applied |
| New IGCC plant (with capture). If a feasibility study is successful, planning application could be submitted within 12 months. Plant will require government support. | | | | |
| **High Marnham** | E.ON | 1,600 | 2012 | Not Applied |
| Supercritical plant. E.ON looking to apply for a scoping study very soon. | | | | |
| **Teesside** | Centrica/ Progressive | 800 | 2012 | Not Applied |
| New IGCC plant (with capture). Scoping and feasibility studies currently being carried out. Will require government support for CCS. | | | | |
| **Wansbeck/Blyth** | Progressive Energy | 800 | 2014 | Not Applied |
| New IGCC plant. On hold as Progressive are focussing on the Teesside development. | | | | |
| **Hatfield** | Powerfuel | 800 | | Not Applied |
| New IGCC plant (with capture). Previous consent was granted to a much smaller development. May depend on government support of CCS development. Has transmission agreement for 2011. FEED study started. | | | | |
| **Blyth** | RWE | 2,400 | 2014 | Not Applied |
| Supercritical plant. Environmental scoping document has been submitted. Plant will be designed to be 'carbon capture ready'. However, the local borough council has raised issues with this development. | | | | |
| **Westfield** | Global Energy | 400 | 2010 | Not Applied |
| New IGCC plant (with storage) is being considered at Global's Westfield site in Fife. | | | | |
| **Cockenzie** | Scottish Power | 1,200 | 2012 | |
| Supercritical plant. Designed to be 'carbon capture ready'. | | | | |
| **Longannet** | Scottish Power | 2,400 | 2012 | |
| Supercritical plant. Designed to be 'carbon capture ready'. | | | | |

Source: IPA/Platts

It is interesting to note that SSE has recently backed away from a proposed retro-fit at Ferrybridge, although it is putting forward plans for new build at the site reusing site infrastructure – effectively delaying the investment decision.

### Conclusions

There are considerable uncertainties over the future of coal, not least the continuing policy vacuum over phase three of the EU ETS and beyond, as well as the potential for ever tightening emissions limits. However, there is a considerable amount of investment going into installing FGD on existing coal plant, as well as investment in increasing plant efficiencies and increasing levels of biomass burn. This coupled with a commodity market that shows coal maintaining a competitive position over the forward curve suggest that coal is going to play an important role in the generation mix into the future.

Perhaps the single most important issue that will influence the long term future of coal will be the successful development of CCS from a technical, economic, regulatory and legal perspective. Its successful development could give coal a long term future in a carbon constrained world. But a sharp increase in the cost of gas or concerns over the security of gas supply could also see the importance of coal in the generation mix brought sharply into focus.

The high level of interest of developers in new coal plant suggests that if the economics are right we could see a significant volume of new coal capacity commissioning in the future. Ultimately, this will require some certainty over the policy frameworks governing emissions in terms of both carbon costs and emissions limits.

Certainly the major utilities have all built generation portfolios with a mix of coal, gas and peaking plant, effectively providing them a hedge against commodity price volatility, and they will want to maintain this type of hedge within their portfolios into the future. It is therefore likely that we will see coal projects continuing to be progressed, providing a physical option hedging commodity price volatility and regulatory uncertainty, but whether we will ever see shiny new coal plant commissioning and a continuing renaissance for coal is still very uncertain.

** Michael Wagner is an associate director at IPA Energy + Water Consulting, and leads the trading risk and analytics team.* *Acknowledgement: Daniel Jefferson, Ken Miller and Suilven Weatherhead, consultants at IPA, contributed to the research contained in this article.*