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A response by

The European Environmental Bureau
The Swedish NGO Secretariat on Acid Rain
Friends of the Earth (England, Wales & N.Ireland)

to

A Draft EGTEI Background Document
On
Combustion Sector
(Part 1: Plants > 500 MW_{th})

Eurelectric BREF vs LCP TWG BREF

The EGTEI Report presents Eurelectric's 'BREF' as a source of information alternative to the LCP BREF that was determined by the Large Combustion Plant Technical Working Group (TWG) in the Seville process. We do not accept the validity of this for the following reasons.

Eurelectric produced its own BREF together with a number of other submissions as its contribution to the information exchange process, which it is, of course, entitled to do. However, all such submissions had to undergo verification and TWG review, and whilst some of Eurelectric's material made a valuable contribution to the final LCP BREF, other material was rejected by the TWG.

As a result, those parts of Eurelectric's submissions judged to be valid are already incorporated into the LCP BREF, and the two BREFs therefore accord on these counts. Thus, Eurelectric's BREF only constitutes a separate information source in those parts where it differs from the LCP BREF, and these differences result from the rejection of their material by the LCP TWG. By contrast, the LCP BREF results from the multi-party information exchange process required by Article 16 of the IPPC Directive. It is for this reason that we do not regard the Eurelectric BREF as any valid alternative to the LCP BREF

More specifically, the ultimate objective of the technical content of any BREF is the specification of benchmark BAT standards for the sector under consideration.

Eurelectric has repeatedly challenged the BAT standards arising from the work of the LCP TWG, arguing that the LCP BREF BAT standards do not represent the reality of commercial operation. It therefore circulated its own Executive Summary containing its own BAT standards to all members of the Information Exchange Forum (IEF) whose task it was to decide whether to adopt the LCP BREF at their meeting in Brussels in December 2004.

The European Environmental Bureau produced its own paper in response to that of Eurelectric (see Appendix 1), and this too was circulated to all members of the IEF. This paper provided technical support for the LCP BREF BAT standards and opposed those of Eurelectric, drawing upon a variety of sources including practice across Germany, Austria, Sweden and Finland, the UK Environment Agency, the UK Department of Trade and Industry, and guarantees regularly given by systems manufacturers – all of which refer to commercial operation. The EEB used this paper to respond to Eurelectric in the IEF meeting, and that meeting agreed to adopt the LCP BREF. This therefore gives the LCP BREF a further validity not shared by the Eurelectric BREF.

SO_2 abatement

The RAINS moddel assumes SO_2 removal efficiencies of 90% for retrofitted plants, 95% for new plants and 98% for high efficiency FGD. EGTEI dispute this, in favour of figures of 85%, 90% and 95% respectively.

In support of their case, the EGTEI Report correctly cites the 2nd draft of the LCP BREF as presenting wet scrubber SO_2 removal efficiencies as 85% - 98% for solid fuels and 92% - 98% for liquid fuels for plants > 100 MW_{th}. However, it would not be valid to infer from this, -- as EGTEI does – that RAINS should adopt an 85% SO_2 removal efficiency for retrofitted plants. This is because there are a number of different wet scrubber technologies, and these vary in their relevance to the specification of a SO_2 removal efficiency. For example, magnesium and ammonia wet scrubbers are not relevant to a study of plants > 500 MW_{th}[1], which is the basis of the EGTEI Report. By contrast, table 3.3.7 of both the 2nd and final LCP BREF drafts makes quite clear that wet lime/limestone FGD makes up 80% of all installed FGD, and has *general* removal efficiencies of 92%-98%, depending upon the absorber type.

This figure is supported by evidence from existing plants in the UK that, at the 500 – 600 MW_e scale, have (wet limestone) FGD removal efficiencies of 90% - 92% [1]. The UK is not one of Europe's most advanced MSs with regards to retrofitting pollution abatement equipment, but equally, this means that the UK only started fitting FGD in the mid-1990s, some time after countries like Germany. However, as the data presented in Appendix 2 shows, there is also a significant number of pre-1990 plants, mostly in Germany, that are achieving SO_2 removal efficiencies of 90% or more, with some exceeding 95% [2]. This is supported by performance data collected in specifically German research [4].

[1] Magnesium wet scrubbers have mainly been applied to plants < 50 MW_{th}. Regarding ammonia wet scrubbers, an excess of the ammonium sulphate by-product in industrialised societies means that the process is seldom used.

The term 'wet scrubbers' also includes seawater scrubbers. However, the *general* SO_2 reduction rate of these seawater scrubbers -- 85% - 98%[2] -- does little to reduce the overall reduction rate of wet scrubbers because, as the LCP BREF makes clear, only a few units are in operation.[3]

Further, it is also appears misleading to ascribe to the 2nd (and/or Final) drafts of the LCP BREF the claim that wet scrubbers have *'a 90% maximum value in specific cases'* [EGTEI, table 2.4]. The only reference that we can find to 'up to 90% SO_2 removal in specific cases' is as follows:

The specific technique used depends on a variety of plant- and site-specific factors, such as the location, the thermal capacity and the load factor of the particular plant, as well as the fuel and ash quality, eg. certain low quality lignites with high alkaline ash and low sulphur content generates (due to the natural desulphurisation that takes place during combustion) lower SO_2 emissions, that may even correspond in specific cases to up to 90% SO_2 removal.[4]

This is very different from stating that wet scrubbers have a 90% maximum removal efficiency value in specific cases.

Neither do the removal efficiencies of spray dry scrubbers constitute any valid reason for reducing the SO_2 removal efficiencies specified in the RAINS model. Whilst spray dry scrubbers make up 74% of worldwide dry FGD capacity, wet limestone scrubbers are still overwhelmingly dominant. Further, as is indicated in the EGTEI Report (table 2.4), spray dry scrubbers are better suited to small units or low load factors, and this gives them a marginal relevance to SO_2 removal efficiencies for plants > 500 MW_{th}, the focus of this EGTEI Report. In addition, although the LCP BREF cites removal efficiencies of 80% - 92% for spray dry scrubbers operating on solid fuels, Appendix 3 gives examples of solid fuel plants operating with removal efficiencies higher than that.

Similarly, whilst the EGTEI Report correctly cites the LCP BREF as identifying a SO_2 removal efficiency of 85% - 92% for liquid fuels with spray dry scrubbers, the relevance of this to the RAINS SO_2 removal efficiency is again limited by the dominance of wet limestone systems and the fact, acknowledged in the BREF, that dry FGD techniques are mainly used for liquid-fuelled plants with a thermal capacity of < 300 MW_{th}.

As a result of these factors:

- the dominance of wet limestone FGD
- its specified general removal efficiencies
- existing plant data
- the irrelevance of magnesium and ammonia wet scrubbers
- the limited application of seawater FGD and spray dry scrubbers

[2] 2nd Draft of the LCP BREF (March 2003), Section 3.3.7, table 3.6, page 86
Final Draft of the LCP BREF (November 2004), Section 3.3.7, table 3.6, page 90
[3] Final Draft of the LCP BREF (November 2004), Section 3.3.7, table 3.6, page 90
[4] 2nd Draft of the LCP BREF (March 2003), Section 4.1.7.1.5, page 167
Final Draft of the LCP BREF (November 2004), Section 4.1.9.1.5, page 181

we conclude that the RAINS SO_2 removal efficiencies of 90% for retrofitted plants, 95% for new plants and 98% for high efficiency FGD are lower than can be justified by the available technical evidence. In reality, a removal efficiency of at least 95% is appropriate for retrofitted plants, with new plants achieving 98%.

NOx abatement

Table 2.1, page 21, of the EGTEI report shows a high degree of consensus between the LCP BREF and Eurelectric's figures for primary measures for NOx abatement. Both distinguish a range of single or combinations of primary measures, with the highest NOx removal efficiencies being achieved by low-NOx burners (LNBs) plus reburning and/or over fire air (OFA). These are 65% - 75% for solid fuels and 55% - 80% for liquid fuels. The next best NOx removal efficiencies from primary measures are achieved with LNB + OFA – up to 70% for solid fuels and 60% - 75% for liquid fuels.

By contrast, RAINS does not distinguish between the different primary measures, producing removal efficiencies for the whole category i.e. 50% for hard coal and 65% for lignite. Further, it only considers existing plants, regarding primary measures as an integral part of new plants. On this basis, reburning is less applicable because it is better suited to new plants.

However, OFA can deliver relatively high removal efficiencies at relatively low costs from existing plants; indeed, in addition to already fitted LNBs, it has just been judged to be the indicative IPPC BAT for the UK's aging portfolio of coal-fired plants, many of which are already 35 or more years old [1]. Further, LNB + OFA is also one of the measures, with and without SCR, that has been considered as an additional measure in the report to the European Commission on the review of the Large Combustion Plant Directive [6]. In this report, LNB + OFA, both with and without SCR, were found to be below the average marginal cost of beyond Business-As-Usual measures in the RAINS Web cost curves – this is a useful gauge of its cost effectiveness, although other factors also have to be taken into account. It is therefore reasonable that this technology should form the basis of the removal efficiencies adopted by the RAINS model.

The BREF BAT standards represent the benchmark standards for a particular industrial sector. However, the IPPC requirement to take account of local factors in determining site-specific BAT means that the best practical applications could well diverge from the benchmark standards. The US Department of Energy, National Technology Laboratory sets *average* NOx reductions from LNB + OFA fitted to coal-fired plants as 50% - 65% for tangential- and wall-fired boilers [3]. We therefore submit that these figures provide an appropriate basis for assessing the abatement efficiencies that can be achieved using primary measures.

Against this background, we find no justification for EGTEI's proposed abatement efficiency for primary measures of 30% for existing hard and brown coal-fired plants and 40% for new plants. Indeed, the RAINS assumption of 50% for hard coal-fired plants is set at the lowest end of the range of average removal efficiencies achieved in practice, and we therefore think that it is a too conservative estimate. Instead, the NOx abatement efficiency for primary measures for coal should be set at 60%.

Further, given that the LCP BREF sets the NOx abatement efficiency for OFA fitted to liquid fuelled plants higher than those for coal, we do not accept EGTEI's proposed figures for liquid fuels that are lower than those that it proposes for coal i.e. 20% and 30% for existing and new HF plants compared to 30% and 40% for new and existing coal-fired plants. With the LCP BREF citing LNB + OFA abatement efficiencies of 60% - 75% for liquid-fuelled plants, we think that it is reasonable for RAINS to adopt a figure of at least 70% for these plants.

With regards to secondary NOx abatement, the LCP Directive requirement for existing coal-fired plants > 500 MW_{th} to meet a NOx ELV of 200 mg/Nm^3 by 1st January 2106 places a particular focus on SCR. Indeed, for those plants intending to operate beyond 2015, there is a strong case for requiring SCR as BAT from 2007, given that the costs of this earlier retrofitting would be simply the operational and maintenance costs 2007 – 2015. For new plants, SCR would inevitably be BAT for plants of this size.

However, with regards to how this should be reflected in the RAINS model, the EGTEI Report proposes a NOx removal efficiency of 75% for existing plants, which isn't even on the LCP BREF scale for SCR of 80% - 95%. Further, at 80%, the current RAINS NOx removal efficiency for new plants is set at the very bottom of the LCP BREF scale. We therefore submit that more realistic SCR NOx abatement efficiencies are 80% for existing plants and 85% for new ones. These figures comfortably accord with a UK estimate of 85% for the *typically* achievable emission reduction for SCR [1]. They also easily reflect the conclusions for SCR abatement efficiencies resulting from research within Germany i.e. 85% - 90% for coal-fired plants and 80% - 90% for oil-fired plants [4].

Our own proposals also better accord with what has been achieved in Europe using a combination of primary and secondary measures at plants that are decades old, mainly in Germany[5]. Combining EGTEI's assumptions about primary and secondary measures results in a combined 'primary measures + SCR' removal efficiency of 82.5% for existing and 91% for new coal-fired plants. However, as Appendix 4 shows, this significantly underestimates the actual removal efficiencies achieved at a significant number of plants, and this conclusion is further supported by research within Germany [4].

It is as a result of these factors:

- the relatively inexpensive facility of LNB + OFA
- the average removal efficiencies of LNB + OFA
- the particular relevance of SCR to plants > 500 MW_{th}
- existing plant data
- the resulting removal efficiencies for LNB + OFA + SCR

[5] The IEA Clean Coal Centre states that out of a worldwide 53 GW_e capacity fitted with SCR, 30 GW_e is in Germany (www.iea-coal.org.uk)

that we conclude as follows. RAINS should assume primary NOx removal efficiencies for coal and liquid fuels of at least 60% and 70% respectively. It should also assume NOx removal efficiencies of at least 80% for existing plants and 85% for new plants.

Dust abatement

Firstly, we do not accept the statement attributed to Eurelectric that fabric filters (FFs) are not used in oil-fired boilers for safety reasons (section 2.5, table 2.5, page 25). Fabric filters can be used for oil, diesel, oil residues and orimulsion-fired boilers provided that a sorbent, such as $Ca(OH)_2$ or $NaHCO_3$ is injected upstream of the filter. The sorbent dilutes the potentially sticky ash/soot from oil firing, that might otherwise cause high-pressure drops over the bags [5]. As a result of technical evidence on this count, FFs are included alongside ESPs as techniques for meeting the dust BAT standards for all size categories of liquid fuelled plants.[6]

Secondly, it should be noted that the EGTEI Report cites lower removal efficiencies for cyclones i.e. 85% - 90% (section 2.5, table 2.5, page 25) but fails to add that these alone are not BAT.[7] It is therefore the performance of ESPs and fabric filters that constitutes BAT and should thus form the basis of RAINS assumptions regarding dust abatement efficiencies.

Beyond that, EGTEI proposes simplifying the RAINS deduster types into 4 types for coal and 1 for heavy fuel oil, based upon achieved abated emission factors (table 3.4, page 41). However we do not agree with EGTEI's proposed lowest achieved abated emission factors. Looking firstly at coal, guarantees of 10 mg/Nm^3 are frequently given for ESPs, with < 1 mg/Nm^3 being sometimes achieved [5]. With fabric filters, guarantees of 1-2 mg/Nm^3 are given, with emissions of <0.1 mg/Nm^3 being sometimes achieved. . At 20 mg/Nm^3, EGTEI's proposal properly reflects neither the LCP BREF BAT standard for coal-fired plants > 300 MW_{th} (5-10 mg/Nm^3 for new plants and 5-20 mg/Nm^3 for existing plants), nor the realities of what is already being achieved in practice. Research on dust emissions from hard and brown coal fired plants in Germany shows that many plants have dust emissions < 10mg/Nm^3, with a number being < 5mg/Nm^3 [4]. We therefore submit that the lowest abated emission factor should be set at 10 mg/Nm^3 for coal-fired plants.

With regards to EGTEI's proposed abated emission factor for oil-fired plants, this is set at the highest emission allowed for by the BAT standards for plants > 300 MW_{th} i.e. at 10 mg/Nm^3, with the BAT standard being 5-10 mg/Nm^3. We find no justification for this when the BREF explicitly states that the BAT standard has been set to take into account the need to reduce fine particulates (PM_{10} and $PM_{2.5}$) and to minimise the emission of heavy metals, since they have a tendency to accumulate preferentially on the fine dust particles. Liquid fuels, especially heavy fuel oil, typically contain particularly high levels of nickel and vanadium, and in this size

[6] The 2nd Draft of the LCP BREF (March 2003), section 6.5.3.2, page370
Final draft of the LCP BREF (November 2004), page 398.

[7] 2nd Draft of the LCP BREF (March 2003), section 4.5.6, page 254.
Final draft of the LCP BREF (November 2004), section 4.5.6, page 271.

range of plant, dust abatement is helped by the fact that wet limestone FGD is also part of the BAT conclusion. We therefore propose a lowest abated emission factor of 5 mg/Nm^3 for liquid fuelled plants.

However, no reason is given for the proposed 'simplification' of the RAINS deduster types, and we do not see what it achieves. As the EGTEI Report itself acknowledges, the type of abatement measure has a big influence on the repartition of the size fraction in the emissions of fine particulate matter. EGTEI's methodology therefore requires calculation for the size fractions PM_{10} and $PM_{2.5}$ after the treatment (section 3.4.3.4, page 44). However, RAINS already takes full account of this, and we do not therefore think that any change is justified on this count.

Costs

We have presented evidence showing that on multiple counts across SO_2, NOx and dust, the EGTEI Report has significantly underestimated the pollution abatement efficiency of available technologies. Indeed, we have repeatedly argued that the abatement removal efficiencies contained in RAINS are also too low. This evidence undermines the validity of the cost calculations that the EGTEI Report sets out to achieve. The end result of the cost calculations is a pollution abatement cost curve for each pollutant for each MS, and incorrect assumptions regarding pollution potential invalidates all 3 parameters on this cost curve – the marginal cost, the remaining emissions and the total cost.

However, underestimation of pollution abatement is not the only problem with the cost calculations – the lifetime of control equipment for SO_2, NOx and dust is also unrealistic. EGTEI takes this as 10 years for new and existing plants, which is immediately questioned by Entec UK Ltd, who assume a 15 year economic life in their consideration of additional measures for the Large Combustion Plant Directive [6]. However, there is technical evidence to support our understanding that control equipment can last the lifetime of the plant; for example, Alstom Power claims that the lifetime of an ESP can be several decades providing recommended maintenance is done properly [5]. Alstom Power has also provided us with the technical advice that for DeNOx and FGD, it is common to regard 30-40 years as the lifetime for the abatement equipment, although new rubber has to be put in the absorber after 10 to 15 years. Such differences in the assumed lifetime of control equipment radically affect cost functions such as the annualised costs, the cost per tonne of pollutant abated, etc.

However, if pollution control equipment can last for several decades, then its costs could well be further overestimated by unrealistically low assumptions regarding the lifetime of plants. RAINS assumes 30 years for new plants and 20 years for existing ones, and this may be realistic for the most progressive EU countries. However, it is not the case for other MSs, such as the UK.

Appendix 5 sets out commissioning dates for the UK's portfolio of coal-fired power plants, and this shows that most of these plants are already at least 30 years old, with several being more than 35 years old. However, some of them are only now fitting FGD, with a view to operating to 2015 or longer. The UK Government has estimated that 6 GW_e of coal-fired capacity will fit SCR and continue in operation beyond 2015, with another 6 GW_e capacity operating on reduced loads beyond that date [7]. Those plants fitting SCR will almost certainly include the 4 GW_e Drax plant, which is expected to operate until 2024. By this time, it will be 52 years old. Other plants closing in 2015 will be almost 50 years old.

If Drax fulfils its expected lifespan, then its FGD equipment, fitted in the mid-1990s, will be almost 30 years old i.e. the life of the control equipment will be nearly 50% longer than the expected lifespan of existing plants. Again, this undermines cost calculations based on assumed plant and control equipment lifetimes, resulting in costs being significantly overestimated.

Costs also appear to have been overestimated by EGTEI's failure to <u>differentiate the investment coefficients according to plant size</u> when calculating the investment costs for plants of 800 MW_{th} and 1800 MW_{th} respectively. However, there is significant evidence showing that_investment at the 1800 MW_{th} plant will be proportionately cheaper than at the 800 MW_{th} plant, due to economies of scale. Thus the UK differentiates for costs across this size range for wet limestone scrubbing, spray dry scrubbing, sorbent injection (duct and furnace) and SCR [1]. Similarly, the LCP BREF states that as unit size decreases from 1000 MW_e to 200 MW_e, the initial SCR capital cost can decrease by up to 30%.[8]

Finally, there appears to be some confusion in the <u>cost calculations for primary measures and SCR</u>. Table 3.23 (page 34) is headed *RAINS investment function applied to two capacities 800 and 1800* MW_{th} *for primary measures and* ***SCR without any primary measures already installed*** [emphasis added]. However, after effecting the calculations for primary measures, it then goes on to calculate costs for SCR with primary measures. Separate calculations are then done on the basis of non-RAINS data for primary measures and for SCR without primary measures. Thus although the costs of primary measures are higher under RAINS, EGTEI's SCR costs are higher than those of RAINS. This is not immediately obvious from comparison between tables 3.23 and 3.25, and this is compounded by the title of table 3.23. it is unclear whether this is a matter of data presentation, or whether these apparently non-compatible figures have been fed into the wider calculations.

It is for these reasons:

- underestimation of pollution abatement efficiencies
- underestimation of the lifetime of control equipment
- underestimation of the lifetime of plants
- failure to differentiate investment coefficients according to plant size
- possible confusion over the basis of NOx abatement cost data

that we <u>conclude</u> that the EGTEI cost estimates are too high.

<u>Combustion technologies considered in RAINS</u>

Table 1.2 (page 11) lists the combustion technologies considered in RAINS. This omits gasification, despite the fact that IGCC was accepted as an emerged technology

[8] The 2nd draft of the LCP BREF (March 2003), section 3.4.2.1, page 108.
Final draft of the LCP BREF (November 2004), section 3.4.2.1, page 113.

at the second meeting of the Seville IPPC LCP technical working group[9] and incorporated as such in the final draft of the LCP BREF.[10] Compared to super-critical and ultra-super-critical combustion technologies, IGCCs currently have no significant environmental advantage and suffer from the disadvantages of being both more expensive and an entirely new technology, compared with (ultra) supercritical combustion that is a step change in an already well-established steam technology.

However, IGCCs are set to become more competitive with the emergence of carbon capture technology, the take-up of which will be driven by the need to meet climate change targets. Carbon capture is a far more direct and therefore cheaper process for IGCCs than it is for steam technologies. We therefore think that this technology should be included in the RAINS model. Beyond this, it is our understanding that the emerging technologies project will be addressing the issue of further technological advances over the relevant time period.

Bibliography

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[6] *Preparation of the review relating to the Large Combustion Plant Directive:* a Report for European Commission, Environment Directorate General; Final Report 2005; Entec UK Ltd.

[7] *United Kingdom National Emission Reduction Plan for implementation of the revised Large Combustion Plant Directive (2001/80/EC);* UK Department for the Environment, Food and Rural Affairs; UK; March 2005.

[9] November 2003
[10] Final draft of the LCP BREF (November 2004).

APPENDIX 1

LCP BREF

The European Environmental Bureau's position on the LCP BREF and its response to comments submitted by Eurelectric to members of the IEF group

The EEB's view of the LCP BREF

Within its resource limitations, the European Environmental Bureau (EEB) has taken part in all the key stages of the work of the LCP BREF Technical Working Group. At all times, we have tried to ensure that we are technically correct and acting in accordance with both the legal definition of what is a BAT standard and the proper procedures of the TWG, and it is our view that both the BREF and the Executive Summary properly reflect these considerations. By contrast, we think that the submission from Eurelectric fails to take account of these issues on multiple fundamental counts, which we identify below. The EEB therefore concludes that the LCP BREF properly reflects BAT for the LCP sector, and does so in accordance with the views of the majority of the technical working group members.

BAT for the LCP sector

Eurelectric states that it *'does not consider that the BREF sufficiently addresses what is practical and achievable for all plant across the sector. In particular, it views the examples of plant performance as unrepresentative, since they concentrate on 'best ever' emissions, taken from isolated cases, rather than reflecting the spectrum of feasible performance for plant operating under commercial conditions and loading patterns'*.

However, in our opinion, this both misrepresents the concept of BAT and makes statements that are not adequately substantiated. Firstly, the BREF cannot be criticised for failing to take account of loading patterns because this is not its role. Eurelectric claims to have based its submission on the structure of the Executive Summary, but it has changed that structure and its content in significant ways. One of these is to omit the Executive Summary statement that *'the choice of system employed at a facility is based on the loads ...'* i.e. load factor is a local consideration which, under Article 9 of the IPPC Directive, is taken into account in the setting of the legally binding BAT permit conditions for the individual installation. This is not the role of the BAT standards that are set in the BREF because these are non-legally binding benchmark standards, to which local technical, environmental and geographical factors have to be subsequently applied for each individual installation. The BREF makes quite clear that the BAT standards refer to baseload operation, and that at other load factors, plant efficiency etc will differ from the BAT standard.

Secondly, there is an important distinction to be made between basing BAT on what may, on occasion, be just a few practical applications and claiming, as Eurelectric does, that these are isolated cases. To summarise the definition of BAT contained in Article 2 of the IPPC Directive, the BAT standards have to reflect the best techniques currently in existence that are judged to be available to the sector as a whole, taking account of economic and technical considerations. This may or may not be represented by ELVs adopted by a few Member States or at a few applications, but the crucial test is whether it is economically and technically justifiable for these to be extended to the sector as a whole, as is required by the legal definition of BAT.

It is the EEB's experience in the LCP TWG that this key test – i.e.whether the standard can be generalised across the sector as a whole -- has been applied rigorously. For example, amongst a number of technical submissions that we made for potential BAT techniques was one for Flowpac, a desulphurisation technique relying upon natural circulation of the slurry. This is achieving very high levels of abatement at a heavy oil-fired power plant at Karlshamn in Sweden. However, the verification process concluded that these levels of abatement are too reliant upon site-specific characteristics to represent BAT, and the EEB accepted this conclusion.

It is therefore not sufficient for Eurelectric to allege that a few applications cannot be BAT – they can be. Indeed, were this not to be so, then BAT would never be able to reflect new technical advances, which necessarily start with a few applications. And if Eurelectric wishes to argue against the adoption of specific ELVs as BAT then it has to show that the practical application of these standards cannot be generalised across the industrial sector as a whole. It is not sufficient to assert that they do not reflect the spectrum of feasible performance – they are not meant to because they are benchmark standards. Neither is it adequate to cite commercial conditions – these BAT standards are set on the basis of plants that are operating commercially. By contrast, the evidence available to the EEB is that proper account has been taken by the EIPPCB of the requirement for BAT standards to have the potential to be generalised across the sector as a whole..

<u>Eurelectric's BAT standards</u>

The BAT standards contained in Eurelectric's submission differ significantly from those agreed by the LCP TWG. This was a technical debate in which the Eurelectric view was not always accepted, and the restatement of these split views does not remove the technical flaws from them as BAT proposals. In our opinion, there are so many flaws in these split views that a full account of these would effectively substantially re-run the technical debate of the 2nd TWG meeting. This is not the purpose of an IEF meeting, so we will simply present an illustrative sample of the points that the EEB could raise in criticism of them:

- Eurelectric seeks to qualify the proposed efficiency BAT standards for coal and lignite fired plants by making them applicable to unit sizes >500 MW_{th}. However, it is unacceptable for them to try to restrict the actual setting of BAT standards to one particular plant size category – what about energy efficiency BAT standards for plants < 500 MW_{th}? Further, we have no record or recollection of this being any part of split views expressed in the TWG

- It is entirely unacceptable to lower the BAT efficiency standard for existing coal and lignite fired plants to include plants with efficiencies as low as 30%. As the EEB made clear in the TWG meeting, this would mean that 40 year old plants in the UK (which would have been retired from use in some MSs) would be regarded as meeting the BAT standard.

- It is not acceptable to reduce the upper end of the efficiency BAT standard for new coal and lignite fired PC plants from 47% to 46%, as Eurelectric proposes. The UK's Department of Trade and Industry assumes a typical efficiency for supercritical power generation to be 46% LHV, with 47% LHV efficiencies being achieved in the latest installations [1]. Further, just this last October, one of Eurelectric's own representatives at the 2nd TWG meeting presented a conference paper citing typical average efficiencies of new coal plants (>400 MW_e) as being 47% in 2000 [2].

- It is not acceptable for Eurelectric to try and subsume the efficiency BAT standard for new PFBC plants within that of a general FBC category without increasing that standard to take account of the fact that PFBC plants have higher efficiencies. These higher efficiencies are recognised in the final draft BREF, as well as elsewhere [3]

- Eurelectric proposes to extend the lower limit of the BAT standard range for the efficiencies of CCG from 50% to 40%. However, 40% CCGT efficiencies date from so long ago that they no longer feature in modern accounts of the historical evolution of CCGT efficiencies, given that efficiencies of 47% were already being achieved as long ago as 1983/84 [4]. It is therefore ridiculous to suggest that the BAT standard should be extended to include CCGT plants operating at 40% efficiencies.

- Dust emission guarantees as low as 1-2 mg/Nm^3 are sometimes given for fabric filters, with guarantees of 5 mg/Nm^3 being normally given [5]. Reducing the upper level of the dust BAT standards for all categories of plants from 5 mg/Nm3 to 10 mg/Nm^3 cannot therefore be justified. This is supported by data from a number of German plants [6].

- The data from German plants also shows that although smaller coal and lignite plants tend to have higher dust emissions than the larger ones, these are still within -- and often well within – the lower levels of the dust standards for existing plants [6]. Extending the lower end of the dust BAT standards cannot therefore be justified.

- There is no justification for extending the lower SO_2 BAT standard limit for existing FBC plants in the 100-300 MW_{th} range from 250 mg/Nm^3 to 300 Nm^3. The very first commercial application of this technology, in the form of PFBC, was the Vartan plant (2 x 70 MW_e) in Stockholm, Sweden, which started operation in February 1990. By 1995, this was reporting SO_2 emissions of 170 mg/Nm^3 [7].

- Whilst SO_2 data is relatively limited for smaller plants, that which is available for Germany shows that existing coal and lignite PC plants <300 MW_{th}

(including < 100 MW_{th}) have SO_2 emissions less than 140mg/Nm^3 [6]. It is therefore not reasonable to suggest that the lower end of the BAT range for coal and lignite PC plants in the 100-300 MW_{th} range should be extended from 250 mg/Nm^3 to 600 mg/Nm^3.

- There is an existing plant in Germany in the >500 MW_{th} size category that is achieving SO_2 emissions of 20 mg/Nm^3 using wet limestone FGD [6]. As this is a very commonly used technique that has been judged to be BAT, then unless a case is put forward showing that these emissions could not be standard for coal and lignite fired PC plants >300 MW_{th}. It is therefore not acceptable for Eurlectric to try and increase this limit to 50mg/Nm^3 for new plants and 100 mg/Nm^3 for existing plants, particularly as there are a further generalised to other sites, this has to form the upper limit of the SO2 BAT 3 German plants using wet limestone FGD that are achieving SO_2 emissions <100 mg/Nm^3.

- Neither is it acceptable to extend the lower limit of the SO_2 BAT standard for existing plants >300 MW_{th} from 200 mg/Nm3 to 400 mg/Nm^3, as Eurelectric proposes in its split view. There are a significant number of plants already achieving emissions lower than 200 mg/Nm^3 in Sweden, Austria, Germany, the Netherlands and Finland [8]

- Lignite plants can generally achieve NOx emissions of 200 mg/Nm^3 without SCR, as is implicitly recognised in the technologies specified for meeting the lignite NOx BAT standards i.e. primary measures. These are relatively inexpensive compared with the cost of additional secondary abatement measures, and given the particular focus of IPPC on prioritising prevention over control, there is no justification for any BAT standard other than that which can be achieved with these measures. Therefore, Eurelectric's view that the lower limit of the NOx BAT standard for existing lignite plants >100 MW_{th} should be increased from 200 mg/Nm^3 to 450 mg/Nm^3 cannot be justified.

- The UK's Process Guidance Notes for combustion processes undermine Eurelectirc's view that the lower end of the CFBC/BFBC NOx BAT standard for plants 100-300 MW_{th} should be increased from 200 mg/Nm^3 to 300 mg/Nm^3. These Guidance Notes set the levels of achievable NOx releases to air as 200 mg/Nm^3 for CFBC without secondary measures and 60 mg/Nm^3 for PFBC with SNCR [9], so even Eurelctric's attempt to 'lose' any requirement for secondary measures cannot justify increasing the BAT standard. However, given the relative inexpensiveness of SCNR, the attempt to 'lose' it can also not be justified.

- Eurelectric agrees with the draft final BREF specification of SCR as a BAT technique for coal PC plants in the 100-300 MW_{th} range. It is well established that SCR achieves emission levels of 200 mg/Nm^3 – Alstom Power regularly gives such guarantees on its Denit SCR system, and the UK's Process Guidance Notes set the same level as an achievable release for coal PC plants with SCR [9]. It is therefore not acceptable to suggest that the lower end of the

NOx BAT standard for 100-300 MW_{th} coal PC plants should be extended to 300 mg/Nm^3.

- Eurelectric argues that the upper end of the BAT range for new and existing PC coal-fired plants in the 100-300 MW_{th} capacity range, and existing plants in the >300 MW_{th} range should all be reduced to 100 mg/Nm^3 instead of 90 mg/Nm^3.However, Alstom Power, one of the major system providers of SCR, cite 50-100mg/Nm^3 as the typical maximum that emission levels can reasonably be expected to go down to [10]

The omission of EPER data

Eurelectric has chosen to submit a paper based upon the structure of the Executive Summary, but to omit an important table of EPER data showing the very significant contribution of LCPs to emissions from IPPC installations for particular pollutants. As EPER data was only published in the spring of 2004, it was not possible for it to be discussed at the 2nd TWG meeting for LCPs. Eurelectric might not like this data, but in our opinion it is an important and relevant addition to the LCP BREF and Executive Summary. EPER threshold values have been specifically fixed at levels that aim to cover 90% of emissions covered by IPPC [11]. Further, the focus of this data on point sources reflects the focus of the CORINAIR data contained in the 2n draft of the BREF – EPER simply replaces CORINAIR with more up-to-date data. Data is also available on the EPER website that puts the emissions from point sources within the context of emissions from all sources for key pollutants [11].

Environmental impacts

In lieu of the table of EPER data contained in the BREF Executive Summary, Eurelectric introduces a table which differentiates between 'significant' and 'not-significant' LCP emissions to air. In this, it differs from the LCPBREF Executive Summary, which refers to 'most important submissions' in addition to 'other substances [that are] emitted in smaller quantities *'but may have a significant influence on the environment due to their toxicity or their persistence',*' [emphasis added]. This final qualifying phrase is omitted by Eurelectric, wrongly in our opinion. For example, in setting non-legally-binding limit values for heavy metals, the 4th Daughter Directive recognises the particular importance of IPPC in setting standards for individual installations, and LCPs have a particular importance as emitters of heavy metals.

Degree of consensus

Eurelectric's submission omits the section on 'degree of consensus' contained in the Executive Summary of the LCP BREF. However, the EEB endorses the EIPPBC's conclusion that the BREF document is supported by the majority of the TWG members. As our own notes of that meeting confirm, it was made quite clear to the TWG that consensus is never determined by voting. Rather, proposals were put forward on the basis of all the comments received on each topic in the consultation on the 2nd draft of the BREF document. These proposals were then debated, and if a consensus was achieved for their amendment, then this was reflected in the conclusion. In the event of a lack of consensus, then all parties were free to register a split view on the conclusion reached. However, in the 2nd TWG meeting, split views were repeatedly being put forward with no technical justification whatsoever or, subsequently, with a very weak one, as illustrated in our sample technical comments above. It is therefore entirely appropriate that these should not be adopted as BAT. We therefore conclude by reiterating the EEB's view that the LCP BREF properly reflects BAT for the LCP sector, and does so in accordance with the views of the majority of the technical working group members.

<u>Notes and References</u>

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*[3] S2 1.01 Combustion Processes: Large Boilers and Furnaces 50*MW_{th} *and over:* London: HMSO, November 1995.

[4] Modern Combined Cycle Power Plants – Improvement of a High Efficient and Clean Technology: Olaf Kreyenberg, H Schutz & Heimo Friede; Siemens PG; presented at the European Conference on Energy Efficiency in IPPC Installations, Vienna, 21st and 22nd October 2004.

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[6] Exemplary investigation into the state of practical realisation of integrated environmental protection with regard to large combustion plants in Germany: O.Rentz, R.Guttling, U.Karl; French-German Institute for Environmental Research, University of Karlsruhe; November 2002.

[7] *A Review of the Future of Power Generation and Combustion:* DJ White; DoE Report No. DOE/HMIP/RR/93/067; UK, November 1995.

[8] The Worst and the Best: Atmospheric Emissions from Large Point Sources in Europe: Mark Barrett, The Swedish NGO Secretariat on Acid Rain, 2000.

[9] IPC Guidance Note S3 1.01 Combustion Processes Supplementary Note; UK; 2000

[10] Technical opinion provided by Alstom Power to the EEB.

[11] www.eper.cec.eu.int

APPENDIX 2

Wet limestone FGD systems on European coal-fired plants [2]

Country	Plant	Date of FGD installation	Removal efficiency %
AUS	Riedersbach	1993	95
DEU	Kiel	1987	95
NLD	Gelderland	1988	90
DEU	Muenchen Nord	1992	99
DEU	Hafen Hamburg	1987	93
DEU	Staudinger	1992	93
AUT	Mellach	1986	90
DEU	Schwandorf	1989	95
DEU	Tiefstack neu	1993	96
DEU	Mannheim	1992	90
DEU	Aschaffenburg	1987	92
DEU	Rostock	1994	95
DEU	Zolling-Leininerwerk	1985	90
DEU	Franken II	1986	90
DEU	Herne	1989	93
DEU	Veltheim	1987	94
DEU	Knepper	1987	95
DEU	Voerde	1985	95
DEU	Chemnitz Nord	1996	98
DEU	Wilhelmshaven	1986	90
DEU	Farge	1988	92
DEU	Reuter West	1989	92
DEU	Werdohl-Elverlingsen	1988	94
DEU	Buschhaus	1987	98
DEU	Rudow	1988	95
DEU	Heyden	1987	92
DEU	Reuter	1988	92
DEU	Shamrock	1988	95
DEU	Munsdorf Pheonix	1996	95
POL	Dolna Odra		90
DEU	West	1987	95
DEU	Dattein	1988	95
DEU	Westerholt	1988	95

AUS = Auistria   NDL = Netherlands   DEU = Germany   POL = Poland

APPENDIX 3

Limestone spray dry FGD on European coal-fired plants [2]

Country	Plant	Date of FGD installation	Removal efficiency %
SWE	Vasteras	1991	95
AUT	Duemrohr VKG	1995	90
AUT	Duemrohr ENV	1996	90
DEU	Cuno-Herdecke	1987	90
DEU	Sandreuth	1987	90
FIN	Martinlaakso	1993	95
DEU	Frankfurt Hoechst	1988	90
SWE	Vaesthamnsverket	1986	90
POL	Laziska	1999	95
DEU	Walheim	1987	95

SWE = Sweden FIN = Finland DEU = Germany POL = Poland
AUT = Austria

APPENDIX 4

NOx abatement achieved at existing European coal-fired plants [2]

Country	Plant	Overall level of NOx abatement (%)
SWE	Vasteras	92
DEU	Kiel	89
AUT	Duernrohr VKG	86
DEU	Hafen Hamburg	83
DEU	Staudinger	88
AUT	Mellach	86
AUT	Duernrohr ENV	86
DEU	Mannheim	85
DEU	Aschaffenburg	87
DEU	Gersteinwerk	90
DEU	Offenben II	86
DEU	Scholven	85
DEU	Heilbronn	85
DEU	Neckar	86
DEU	Cuno-Herdecke	86
DEU	Wedel	86
DEU	Mainz	87
DEU	Hannover	86
DEU	Sandreuth	96
DEU	Voelklingen HKV	86
DEU	Veltheim	86
DEU	Knepper	93
DEU	Voerde	86
DEU	Wilhelmshaven	90
DEU	Farge	90
DEU	Reuter West	86
DEU	Werdohl-Elverlingsen	88
DEU	Rudow	86
DEU	Heyden	83
DEU	Reuter	86
DEU	Walheim	86
DEU	Shamrock	86
DEU	West	86
DEU	Dattein	86
DEU	Westerholt	86
DEU	Bexbach	84

SWE = Sweden AUT = Austria DEU = Germany

APPENDIX 5

Plant	Year commissioned
Didcot	1972
Tilbury	1968
Cottam	1969
Kingsnorth	1970
Ratcliffe	1968
Ironbridge	1970
Rugeley B	1972
West Burton	1967
Eggborough	1968
Ferrybridge	1966
Fiddlers Ferry	1961
Drax	1974
Aberthaw	1971
Longannet	1972
Cockenzie	1967
Kilroot	1981