Assessment of the Environmental Impacts and Costs arising from Implementation of the LCP and IPPC Directives for Combustion Installations with Multiple Boilers

Final Report
Entec UK Ltd

A consultation response from

The European Environmental Bureau
and
Friends of the Earth
(England, Wales & Northern Ireland)

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Introduction

The European Environmental Bureau (EEB) and Friends of the Earth (FoE) would like to thank Entec for undertaking this difficult but highly relevant study. Friends of the Earth (EWNI) is a member organisation of the EEB, and over several years was involved in the debate upon this issue with the Commission within the context of the UK's LCP Directive compliance strategy. FoE welcomed the Commission's decision in favour of a common stack/windshield basis for defining 'combustion plant' within the LCP Directive, and this view is also shared by the EEB.

The Entec study summary rightly states that:

> *As would be expected, the emissions reductions required and associated benefits increase from a boiler to a flue to a common stack interpretation of combustion plant. This is due to an increased number of boilers and capacity falling under the LCPD as the level of aggregation increases and tighter ELVs applying as the overall flue or common stack is greater in capacity than the individual boilers or flues that it contains.*[1]

This was indeed what was expected at the time of the LCP Directive debate that resulted in the Commission's preference for a common stack/windshield definition. However, this issue clearly also arises within the context of IPPC, and Entec's study is therefore very useful in adding 'flesh' to the 'bones' of the earlier debate.

[1] Section 5.5.1, p.77

Given the previous position of our two organisations on this issue, and the fact that the results of this study are indeed *'as would be expected'*, we take no substantial issue with the study as a whole. On the contrary, we submit to further endorse its findings by suggesting that:

- The study underestimates the emission reductions that can be achieved by adopting a common stack/windshield definition.
- The monetary value of benefits are underestimated to an extent beyond that which is acknowledged in the study[2]
- No consideration has been given to the assumed basis upon which the LCPD ELVs and the IPPC LCP BREF BAT-AELs were determined.

Underestimation of potential emission reductions

Firstly, we wish to look at the assumption that the overshooting of LCPD ELVs could be 'reclaimed' and is therefore accounted for as a negative benefit.

Were it to be the case that the plants in question will comply with the LCPD predominantly through a NERP, then this would justify classifying overshoots as negative benefits -- they could indeed be 'reclaimed' by allowing other plants within the NERP to underachieve their plant limits.

However, this is not the case. Power plants dominate LCP sector emissions, and of the 15 'opted-in' ESI plants included in the study[3], 10 are within MSs that are adopting an ELV approach.[4] A further 2 are within MSs adopting a combined approach, although it is not possible to identify whether they are in the ELV or NERP components within these countries.

Further, overshoots of LCPD ELVs can be seen as an inevitable result of the application of an ELV approach, as has been illustrated by calculations undertaken for NECD and LCPD compliance strategies.[5] In some cases, this is inherent in the nature of the technology used. For example, it is accepted that it is not possible to achieve a SO_2 ELV of 400 mg/Nm^3 (required for existing plants >500 MW_{th}) with low sulphur coal alone, thereby requiring the retrofitting of FGD. However, if that FGD operates at 90% removal efficiency (a very basic rate for retrofitted FGD), and uses medium sulphur coal of 1.2% sulphur content, then it would emit approximately 270 mg/Nm^3 SO_2.

Indeed, even with the burning of coal with a sulphur content as low as 0.6%, it would not be possible to meet the LCPD SO_2 limit for plants > about 350 MW_{th} without the

[2] *Data limitations and uncertainties*:p.80
[3] Table 5.2
[4] Based on data presented in Table 2.1.
[5] For example, this was clearly evident in the UK's internal consultations regarding NECD compliance, and in its various submissions to the European Commission regarding its LCPD compliance strategy. An ELV approach gave the greatest emission reductions, explicitly attributed to inevitably overshooting the ELV, whilst a NERP gave the lowest emission reductions. A combined approach gave emission reductions lying between the two. See UK submission to DG Environment, February 28th 2006.

use of FGD. Once plants of this size range have been fitted with FGD, it would be theoretically possible for them to avoid an overshoot of their LCPD limit by burning fuel with a sulphur content of >5%, but this is not a practical reality given other constraints upon emissions such as the NECD.

Similarly, existing plants have to meet LCPD NOx ELVs of 600 mg/Nm^3 up to and including plant size 500 MW_{th} and 500 mg/Nm^3 >500 MW_{th}. If this is achieved by retrofitting Boosted Over Fire Air, then again an overshoot is inevitable, given that BOFA systems can achieve <300 mg/Nm^3 [6]. Indeed, in their IPPC permit applications, UK power station operators regarded 500 mg/Nm^3 as an ELV that could 'easily' be achieved with BOFA.

As such, in the absence of a national emission reduction plan, it is not realistic to assume that these overshoots of ELVs could be reclaimed; to do so would result in non-compliance with the LCPD.

Further, some overshoots of LCPD ELVs result from some MSs setting national LCP ELVs tighter than those in the LCPD. This is the case for existing plants in Austria for SO_2, NOx and dust; Finland for NOx and dust; France for NOx and dust; Germany for SO_2, NOx and dust; Italy for SO_2, NOx and dust; Sweden for SO2, NOx and dust; Czech Republic for SO_2 and NOx; and Hungary for dust – no information was made available for Denmark, Greece, Luxembourg, the Netherlands, Lithuania, Poland, Slovakia and Slovenia.[7]

Given that these MSs have set and applied these stricter national ELVs, we submit that it is not reasonable to assume that they would subsequently revert to the less stringent limits of the LCPD.

A full assessment of the real extent to which it is reasonable or unreasonable to assume that any overshoot of LCPD ELVs will be 'reclaimed' in practice would be a complex undertaking, and therefore beyond the scope of the multi-boiler study undertaken by Entec. However, for the reasons that we have set out, we submit that an assumption that overshoots should be regarded as potentially reversible is a gross overestimate of what will happen in practice. As such, the emission reductions will be underestimated, as will the benefits in terms of damage costs avoided.

Secondly, we wish to address the issue of the potential impact upon emissions by opted-out plants. During the earlier debate upon this issue, it was claimed that failure to adopt a boiler definition would simply result in opted out plants operating only when all boilers can be operated simultaneously, in order to maximise utilisation of the 20,000 operating hours available to these plants. In theory, this would be the logical result of a common stack/windshield definition, and this possibility is acknowledged in the report.[8] However, in practice, this is highly questionable, as the study itself shows.

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[6] Eg. Mobotec's Rotamix system.

[7] *Preparation of the review relating to the Large Combustion Plant Directive;* A report for European Commission, DG Environment, Draft Final, April 2005; Entec UK Ltd.

[8] *Executive Summary*, p.vii

One reason given for this is the likelihood of national policies constraining the operation of opted-out plants. However, in addition to this, there is evidence that the opted-out plants are opted-out because they lack the ability to compete in the ESI market as an opted-in plant.

This is provided by a study undertaken by OXERA for the Anglo-Welsh Environment Agency, which uses OXERA's electricity wholesale market model to examine the environmental and economic impact of the ELV and NERP approaches within the UK ESI.[9] This modelled the average load factors of all plants in England and Wales if they were all fitted with FGD and adopted an ELV approach, and it produced a range of 16 – 77 % average load factors, This highlights the wide range of competitive abilities of the different plants and the fact that it would not be worthwhile for any plant that could not achieve a 29% load factor opting in – this is the annual load factor equivalent to the 20,000 operating hours available to opted-out plants if those operating hours are spread evenly over the allocated period 2008-15.

This poses the question of whether avoiding the operating costs of FGD by opting out could overcome such a significant innate competitive disadvantage to achieve the simultaneous operation of all boilers for 20,000 operating hours. The anticipated operation data collected by Entec is particularly important in this respect because it shows that operators of the opted-out plants included in the study expect to achieve substantially less than simultaneous operation of all boilers for 20,000 hours.

Even assuming that the summary results include a mid-point assessment of the emissions from opted-out plants[10], the anticipated data suggests that taking the mid-point between full separate and full simultaneous operation would still underestimate the emissions reductions. This underestimation would be by 9% for SO_2, 53% for NOx and 54% for dust, [11] with a corresponding underestimation of benefits in terms of damage costs avoided.

<u>Underestimation of the monetary value of benefits</u>

In the previous section, we have outlined two areas where we think that the monetary value of damage costs avoided are underestimated as a result of underestimations of the emissions reductions. However, there is another way in which the monetary value of benefits is underestimated i.e. limitations upon the ability of all benefits to be monetarised within the CAFÉ programme, upon which the Entec study costs are based.

The Entec study acknowledges two limitations of the data on this count:[12]

- That the damage cost functions under the CAFÉ programme are MS level functions which do not take into account the geographical location of any emission reductions and associated impacts

[9] *Environmental and Economic Impact of the Emission Limit Value and National Plan Approach on the Electricity Supply Industry;* July 1st 2003; OXERA; for the Environment Agency (England & Wales).
[10] See Figure 5.14, p.76
[11] Based on data in Table 5.27, p.71.
[12] Section 5.5.1, p.80, Data limitations and uncertainties

- That they are not specific to LCP processes as they are overall functions for all emission sources considered in the CAFÉ modelling.

However, AEA Technology has identified a number of other impacts that have either been quantified but not valued or simply assessed qualitatively[13] -- these apply to emissions of SO_2, NOx, dust and ozone (for which NOx is a precursor gas). They include:

- Chronic mortality and morbidity due to ozone emissions – these have only been qualitatively assessed
- Direct health effects of SO_2 and NO_2, which have only been qualitatively assessed
- The social and altruistic effects arising from health impacts – these have only been qualitatively assessed
- The direct effects of SO2 and NOx on agricultural production – this has only been qualitatively assessed
- The indirect effects on livestock, which have only been qualitatively assessed
- Visible damage to marketed agricultural produce, which has been qualitatively assessed and the impact quantified, but not valued
- The effects upon agriculture of the interactions between pollutants, with pests and pathogens, climate etc – these have only been qualitatively assessed
- For materials, the effects on cultural assets and steel in reinforced concrete – these have only been qualitatively assessed
- The ecosystem effects on biodiversity, forest production etc arising from excess ozone exposure, excess nitrogen deposition and excess acid deposition – these have only been qualitatively assessed

Other shortcomings of the CAFÉ data have been omitted because they have been assessed as having negligible impact according to previous work.

It is clear from the above list that although the Entec study has already concluded that the benefits in terms of damage costs avoided very significantly outweigh the costs of making the emission reductions, this would be even more so the case if all damage costs were included in the valuation.

The basis upon which ELVs were set

No consideration has been given to the basis upon which the LCPD ELVs and IPPCD BAT-AELs were set, and whether a 'boiler' definition of large combustion plants would have resulted in stricter ELVs/BAT-AELs had it been made explicit. Instead they are regarded as equal options which, on the basis of the information available to us, runs contrary to the basis upon which they were agreed.

During LCPD negotiations, the definition of new LCPs was explicitly set in terms of 'common stack', which has always been understood to mean 'chimney'. A drafting oversight failed to clarify the issue for existing plants, but the Commission

[13] Methodology Paper Issue 4: AEAT/ED51014; AEA Technology

subsequently directed that the 'common stack' definition should also apply to existing plants.

This was accepted by all MSs, including the UK, who subsequently led the challenge on this issue. The UK did this by redefining the term 'common stack' to mean flue, whilst 'common stack-as-chimney' became a 'windshield' – in this way they achieved a 'flue' definition of LCP which largely but not wholly means a 'boiler' definition. However, none of this was made explicit during the negotiations, as was confirmed by Brian Brangan, who was then responsible for the LCPD at the Commission,[14] and the Anglo-Welsh Environment Agency.[15]

Thus the ELVs set for each of the plant size categories, the peak load derogation and the operating hours limit for opted-out plants were all set on the basis of a 'common stack-as-chimney' definition of combustion plant. This formed the basis of the level of environmental ambition of the LCPD, and would have required stricter ELVs for 'flue' and 'boiler' definitions to maintain an equivalent level of environmental ambition. As such, this would further underestimate the proper emission reductions and the benefits in terms of damage costs avoided for 'flue' and 'boiler' definitions.

Whilst this LCPD definitional debate was in progress, it was the EEB's experience on the IPPC LCP Technical Working Group in Seville that the LCP BREF BAT-AELs were being set without any clear definition of the term 'combustion plant'.[16] However, The Seville process as a whole experienced a problem with obtaining real plant emissions data, so plant-by-plant data that was made available to the LCP TWG by Austria and Germany was particularly important in determining BAT-AELs for LCPs.

Austria operates on the basis of a 'common stack/windshield' definition of combustion plant, and would therefore collect and present its data accordingly. Germany operates on a 'flue' definition, but despite that, its case studies -- some of which are presented in the LCP BREF -- refer to 'plant' in terms of multiple boilers, with no specification of 'flue' as being the basis of the definition. [17]

In the subsequent definitional debate within the LCPD, the Commission placed much emphasis upon preserving the level of environmental ambition of the Directive, resulting in its view that 'common stack/windshield' is the proper definition of 'combustion plant' within that context. Given the contemporaneous work of the IPPC LCP TWG, and the failure to specify that it was proceeding on any different basis, it is reasonable to assume that the size categories of the LCP BREF BAT-AELs are similarly based. Therefore, for both Directives with a 'boiler' or 'flue' definition, it is reasonable to assume that the ELVs/BAT-AELs would have been stricter.

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[14] In conversations with Friends of the Earth (England, Wales & N.Ireland)

[15] In a meeting with Lesley James, FoE (EWNI) Acid Rain Campaigner about the Regulatory Framework for Coal- and Oil-Fired Power Generation in England and Wales: 2005-15; November 2004. The EA was represented by Chris Bowers and Neil Davies.

[16] The EEB representative raised this issue in her submissions, but it was not clarified.

[17] *Exemplary investigation into the state of practical realisation of integrated environmental protection with regards to large combustion plants in Germany;* O.Rentz, K.Gutling, U.Karl; French-German Institute for Environmental Research, University of Karlsruhe (TH), Hertzstr. 16,76187 Karlsruhe; Project number 200 46 317; Report on behalf of the Federal Environmental Agency Germany; November 2002.

Conclusion

The European Environmental Bureau and Friends of the Earth (EWNI) have welcomed this study, that has shown – *as would be expected* – that the emission reductions and consequent benefits in terms of damage costs avoided increase with increasing aggregation of the term 'combustion plant'.

We have also shown that in our view, both the emission reductions and damage costs avoided have been underestimated, thereby strengthening the case presented in Entec's study.

Further, we have provided evidence to suggest that adopting any definition of the term 'combustion plant' other than that of 'common stack/windshield' undermines the level of environmental ambition of the LCP and IPPC Directives.

As such, in addition to commending the study, we respectfully request that its findings be interpreted in the light of the points that we have raised with regard to its underestimation of its case.