Background briefing on the

2017 LCP BREF transposition

for coal-fired power plants

Published in August 2020

Update of 2015 CAN-EU abatement techniques briefing

Written by Goran Kovacevik and Christian Schaible

Contacts: goran.kovacevik@eeb.org and jaikrishna.r@eeb.org (technical), christian.schaible@eeb.org

Table of contents

1 Executive summary

This briefing provides background information on the most relevant environmental performance standards applicable to coal-fired Large Combustion Plants (LCPs) operating in the EU, and outlines upcoming opportunities for campaigners on the basis of the EU's environmental protection acquis.

It provides advice for effective implementation of the 2017 Best Available Techniques (BAT) Conclusions document (LCP BREF) under the EU's Industrial Emissions Directive (IED), building on a previous NGO briefing elaborated in 2015 for CAN-EU[1]. The suggestions put forward, i.e. pollution limits and angles to focus on, are the personal opinions of the authors and do not necessarily reflect the position of the EEB, unless specified otherwise.

The main objectives of this briefing are to:

- Set out **pollution limit levels** that should be implemented for larger coal/lignite power plants following the requirements of the Industrial Emissions Directive.
- Focus on the **most relevant aspects of the permitting** phase and environmental aspects linked to lignite mining;

This briefing does **not**:

- Claim to be exhaustive[2], nor pretend to cover every scenario affecting existing coal/lignite power plants in the EU member states;
- Provide information on the basic techniques or functioning of coal/lignite-fired LCPs;
- Suggest that even the best (most effective) techniques can make coal 'clean'. The only way to eliminate the negative impact of coal and lignite will be to keep it in the ground and switch to sustainable forms of renewable energy.

The briefing provides:

- **Suggestions for clear policy asks** vis à vis permit writers that should be considered as minimal expectations;
- **Additional information** on aspects relevant to lignite power plants such as **DeNOx** and **mercury control techniques** that are not available in the 2017 LCP BREF;
- Some information on **cost-benefit considerations** that could be made at the permit review level, what is achievable from NGOs perspective, basic arguments that can be used vis à vis the permitting authority when plant by plant specific action is undertaken;
- Suggestions on lignite mining-related environmental aspects;
- Some guidance on where information for enforcement purposes can be accessed.

---

[1] Please contact CAN-EU if you represent an NGO and are interested in this briefing

[2] Mainly air and water relevant impacts of coal combustion are mentioned, not issues occurring upstream (coal mining) nor climate change implications

2 Why do strict standards matter?

2.1 Coal LCPs and air pollution

Coal-fired power plants are the largest source of SO_2 and mercury emissions in Europe, and one of the largest sources of NOx and other heavy metals. Of the 30 most health-damaging industrial installations identified in the EEA's 2014 report, 26 are coal/lignite fired LCPs[3]. The health impacts of coal-fired LCPs are estimated at more than 16,150 premature deaths, about 7,600 extra cases of chronic bronchitis and over 4.8million lost working days each year in the EU and Western Balkans[4].

The amount of pollution each plant produces is directly related to the level at which Emission Limit Values (ELVs) are set in its permit conditions. All EU permits must now be reviewed to ensure compliance with the revised EU 2017 BAT-C levels. However, the implementation of the new rules offers a large degree of flexibility to permit writers.

The EEB and Greenpeace had already assessed 2015 the impact that differentiated pollution standards could have in terms of avoiding external health costs[5]. The calculations compare 'true BAT levels' and the levels agreed on in the revised BAT conclusions, which were not yet adopted at the time of the report's publication. Country specific results have also been produced[6].

A more recent assessment was made in the 2017 Lifting Europe's Dark Cloud report, which lists the negative impacts of each plant under various compliance scenarios (2013 situation, less strict BREF upper range, true BAT stricter emissions range)[7]. Wider LCP emission data beyond coal fired plants is made available on the Industrial Plants Data Viewer (IPDV)[8].

2.2 When is action to be implemented?

The 2017 LCP BREF **will have to be complied with by August 2021 at the latest.** Permit reviews are therefore already ongoing.

The stringency levels of the ELVs depend on three size classes: 50-100MWth, 100MW-300MWth and above 300MWth. This is in order to factor in economic considerations for the operators to install secondary abatement techniques but also linked to technical fuel-type specific considerations (e.g. lignite or hard coal is differentiated).

For the purpose of this briefing only the >300MWth size category is addressed, which should capture the major point source emitters of coal combustion. Moreover, this briefing covers only "existing plants" (**"existing" in terms of BATs**), i.e. those **permitted prior to 2016.** These make up >98% of the LCPs potentially affected by the standards.

---

[3] EEA 2014 report, table

[4] Based on Europe Beyond Coal: European Coal Plant Database, 15 Jan 2020, https://beyond-coal.eu/data/

[5] Greenpeace and European Environmental Bureau, May 2015 "Health and Economic Implications of Alternative Emission Limits for coal-fired power plants in the EU"

[6] https://eeb.org/library/health-and-economic-impacts-of-alternative-emission-limits-for-coal-power-plants-in-the-eu/

[7] https://eeb.org/library/full-plant-results-lifting-europes-dark-cloud-report/

[8] http://eipie.eu/projects/online-access-to-information

2.3 General overview of the typical emission levels achieved either unabated or with different abatement techniques

The typical EU hard coal LCP is a pulverised boiler with low-NOx burners, potentially combined with further primary NOx abatement and with secondary abatement through Selective Catalytic Reduction (SCR), combined with Electrostatic Precipitator (ESP) (in rare cases “bag/fabric” filter) and wet Flue Gas Desulphurisation (wet FGD).

For fluidised bed boilers, only a few in the EU have the cheaper variant of secondary abatement i.e. Selective non-catalytic reduction (SNCR) for NOx controls, and use Duct Sorbent Injection or Boiler Sorbent Injection for SO2 abatement, in combination with ESP or bag filter for dust abatement.

For lignite-fired LCPs the combustion temperatures are lower, therefore the thermal NOx formation is lower compared to hard coal. So far, primary measures have been sufficient without need for secondary abatement (SCR/SNCR) to meet regulatory limits set in the IED at 200mg/Nm³. As for hard coal, ESPs and Wet FGD are the most common techniques for respectively dust and SO_2 abatement. Even though no mercury-specific techniques are required under the IED, the given emission limits of the new BAT AELs emphasises the importance of mercury emission control. Only a few EU coal/lignite LCPs are implementing dedicated mercury abatement at commercial operating scale at the moment, and few have continuous emission monitoring (CEM) in place.

<u>SO_2</u> emissions can be controlled using lower sulphur fuel, through direct sorbent injection (DSI – used particularly in fluidized bed combustion) and by using dedicated Flue Gas Desulphurization devices (“SO_2 scrubbers”).

Control technique	Indicative range of emission limits that can be complied with (mg/Nm3)
Unabated	800-3,000 (up to 10,000 and above for high-sulphur lignite, 22,000 for about 4% sulphur in fuel)
Low-sulphur coal	800-1,500
DSI	150-1,000
Dry and semi-dry scrubber	100-1,000
Wet scrubber	10-130
BAT level	**Max 10mg/Nm³, achieved with Wet FGD and low sulphur coals. Same for lignite, not to burn fuels with S content>1%.**

NOx emissions can be reduced by modifying the boiler configuration to generate less NOx during combustion (low-NOx burner techniques), through ammonia injection into flue gas to reduce some of the NOx into elemental nitrogen (SNCR – selective non-catalytic reduction), by using catalytic reduction of NOx (SCR) or a combination of those (hybrid).

Control technique (>300MWth boiler)	**Indicative range of emission limits that can be complied with (mg/Nm3)**
Unabated hard coal	500-2,000
Unabated lignite	400-650
Low-NOx burner (LNB) and other primary measures hardcoal	400-600
Low-NOx burner (LNB) and primary measures lignite	125-190 (lower figure with fuel blending and depending on boiler size or configuration)
SNCR + fluidised bed hardcoal	180-400
SNCR PC lignite boilers	90-120 (lower level in combination with primary measures)
SCR PC boilers (hardcoal)	50-150
SCR PC boilers (lignite)	40-120
BAT	**Max 85mg/Nm³ for both coal and lignite (SCR)**

Dust emissions can be controlled with electrostatic precipitators (ESP) and fabric filters (baghouses). Baghouses have better control efficiency for small particles and they also have significant benefits for controlling mercury emissions.

Control technique	**Indicative range of emission limits that can be complied with (mg/Nm3)**
Unabated	~3,000-10,000
ESP (without SO2 controls)	<10-150
Advanced ESP combined with Wet FGD	<5
Baghouse (FF) (without SO2 controls)	5-150
Advanced FF combined with Wet FGD	<3
BAT	**Max 3mg/Nm³ is achieved with ESP or bagfilter (in combination with Wet FGD)**

Mercury emissions are controlled as a co-benefit of wet SO_2 scrubbers, particle controls and SCRs. Baghouses can be particularly effective. Designated mercury control uses injection of activated carbon (ACI) or halogenated additives into the flue gas (or in the boiler) or special oxidation catalysts (triple action SCR). Other techniques such as polymer catalyst layers added to the scrubbers can also be implemented. For the first set of techniques, the abatement effectiveness depends highly on chemical characteristics of the coal being burned, therefore choosing fuels which do not contain mercury is the most effective technique.

Control technique	**Indicative range of emission limits that can be complied with (ug/Nm3)**
Unabated (depends on other controls available, mercury content in fuel	Can be up to 42µg/Nm³
Ancillary benefits from advanced SO_2, NOx, PM controls	1-10 Rheinish lignite plants (Germany) already achieve up to 3µg without dedicated mercury controls due to lower concentrations in fuel[9]

[9] More information available here: https://eeb.org/library/mercury-emissions-from-coal-power-plants-in-germany-de/

Specialized fabric filter	<1
Activated Carbon Injection / GoreModules	<1
BAT	**<1µg/Nm³**

3 Issue #1: Horizontal matters linked to permitting procedure

3.1 General background permitting (principles and derogations)[10]

In principle the upper BAT-AEL should not be exceeded when implementing the 2017 LCP BREF (Art 15.3 of the IED). However, the operator may apply for the so called 'Article 15(4) derogation'. If the achievement of the BAT-AEL would lead to "*disproportionately higher costs compared to the environmental benefits*" due to three local conditions, namely the geographical location or local environmental conditions and the technical characteristics of the installation concerned. It is for the competent authority to assess this derogation application, subject to public consultation.

It is important to highlight that:

a) this specific derogation is without prejudice to the achievement of relevant environmental quality standards (Art 18),

b) the provision implies that it is implicit that higher costs occur due to BAT-C implementation and

c) that "no significant pollution is caused and that a high level of protection of the environment as a whole is achieved".

The Article 15.4 derogation in the current form was opposed by the EEB while the Industrial Emissions Directive (IED) was drafted. First, the stricter BAT-AEL set in the 2017 LCP BREF already correspond to technically and economically viable performance levels, hence they are proportionate. Secondly there is no clarification on how the level of proportionality is to be set. However, it was the result of a compromise to get the binding nature of the BAT-Conclusions firmly accepted, a sort of pressure release valve to improve the ambition level of the BAT benchmarks in the negotiations occurring during the BREF reviews, whilst the real impact will depend on how it is implemented on the ground. More background on the provision is available in the basic briefing on the IED (2011).[11]

3.1.1 Permitting process and procedure

The following list of recommendations for improving the permitting process - especially when derogations are considered - contains both recommendations and demands that are non-exhaustive and not in order of priority:

[10] This paper is just a compilation of what competent authorities should be asked to do when revisiting permits / considering applying a derogation for the coal-fired LCPs. For more information, contact Christian Schaible (EEB): christian.schaible@eeb.org

[11] http://eeb.org/publications/61/industrial-production/4394/new-features-under-the-industrial-emissions-directive.pdf

1. Inform your national Europe Beyond Coal contact point about any derogation application or permit review documents received on LCPs **when all options for the decision are still open** (depending on the member state, the operator has max 1 year = August 2018 to submit its draft to the competent authority). *Please also provide information on applied / granted derogations on the LCP database reporting template*[12] *and send it back to* industrydatabase@eeb.org ;

2. Ensure public participation in case of permit review without derogation (Art 21, 24(1)d + Art 30(7) IED provide for that right "*in the case of a change to a combustion plant that may have consequences for the environment*". A legal dispute has been assessed on that matter by the Aarhus Compliance Committee[13], agreeing with the NGOs (IIDMA/EEB) that the key criterion is whether the reconsideration or update is "capable of" changing the activity's basic parameters or will "address" significant environmental aspects of the activity. It is not decisive whether the operating conditions of the activity will indeed ultimately be updated or will in fact have significant environmental effects. Likewise, it is immaterial that, if the operating conditions are updated the updated conditions could in some respects have a beneficial effect on the environment, human health, and safety. The crucial point is whether the reconsideration or update is "capable of" changing the activity's basic parameters or will "address" significant environmental aspects of the activity It is clear that any change affecting the environment - which may also have positive effects – such as retrofits, is subject to a permit review procedure. The Aarhus Convention supports this understanding and the IED provisions applied in that way. *Report any derogation to IEDderogations@eeb.org and industrydatabase@eeb.org ;*

3. Establish rule for a max 5 years permit limit / derogation only to existing plants.

If an Art. 15.4 IED derogation is applied:

a) **Mandatory trans-boundary public consultation** procedure (Art 26 IED, Art 15.4 extended, Aarhus Convention etc);

b) It shall not be used to buy additional time for retrofitting but constitute a genuine trade-off (public benefits/company costs);

c) Use LCP 2006 LCP BREF "as if" compliance as the starting point of benchmarking for assessing (dis)proportionality, performance levels below IED Annex V part 2 ELVs are a given (exclusion criteria);

d) Mandatory use of the recommendations on Cost Benefit Assements (CBA) by Mike Holland (i.e. using EEA Value of Statistical Life (VSL) for externalized cost or US EPA price levels >7.15 Million € VSL)[14]; Any CBA should be based on the effectiveness of the abatement efficiencies of the techniques;

e) Compare various EU environmental law compliance options at company level (Business As Usual, at least BAT-AEL stricter and upper level, time limited derogation in exchange of shutdowns, fuel switching etc.). Do a cost-benefit ratio for all these options including

[12] Downloadable on sharepoint at this link. Please send back a filled version to industrydatabase@eeb.org
[13] See draft findings here.
[14] https://env-health.org/IMG/pdf/20180129_guidance_on_cba_for_ied_derogations_mholland.pdf

indirect effects such as impacts in other industry (e.g. more costly measure to cut pollution), housing or traffic;

f) Mandatory Environmental Impact Assessment (EIA) (as to point e) with transparency on the various options considered;

g) Consider other environmental impacts resulting for continued operation e.g. climate change, risk of compliance with Environmental Quality Standards – EQS (Art 18 IED). Provide for mandatory quantification of likely impacts of various compliance scenario, ratings need to be provided in terms of effectiveness for compliance against EQS, meaning the abatement efficiencies of various options are considered;

h) Check/validation by at least 3 independent technique providers on the cost figures or other excuses of non-feasibility provided by the applicant with peer review of EU / national level NGO contact point (as to the potential benefits);

i) Only consider validated cross-media impacts (overall environmental impacts) as a valid excuse for a derogation (link to point g).

3.1.2 Demands on substance (pollution levels / if derogation applied)

It is important to remember that the final BAT-C levels are a compromise of what was judged as already applied under economically viable conditions, based on 2010 data. In other words, **when the levels were agreed, neither technical nor economic arguments were advanced that justified why they could not be met by plant operators across Europe**. **This also includes the stricter BAT-AEL ranges[15]**.

In light of objectives set under the energy transition as well as health and environmental protection imperatives, a 1:1 transposition based on the lowest common EU denominator (that is the upper BAT-AEL for existing plants) is therefore out of the question. The operators would surely claim that the costs for the polluters would be dis-proportionate to the benefits, i.e. BAT compliance does not add up for profit-optimisations. This sort of approach does not have anything to do with the 'polluter pays' and prevention principles. In fact, **it is clearly demonstrated that the prevention of pollution through the application of BAT yields significantly more benefits for the public – especially in terms of health - in comparison to the costs to the polluters, even in case of just 5 years of operation[16]**.

The EEB position is that all coal/lignite for power generation should be phased out by the latest in 2030[17]. In the interim the following proposals are to apply as from 2020 to coal-fired combustion plants >300MWth. A temporary derogation may only be considered as a genuine trade-off for a real win such as earlier shut down, and should not be used to buy time for operators.

[15] For more technical arguments and background costs of meeting BAT-AEL, read: "Background briefing on abatement techniques for health relevant pollutants from coal-fired power plants", CAN-EU (October 2015).
[16] See report 'Lifting Europe's Dark Cloud' and full plant results; the EEB's briefing 'Mercury Emissions From Coal Power Plants In Germany'; the EEB's briefing on the LCP BREF transposition in Germany. Other studies could be provided upon request. Note that precise figures are site specific.
[17] EEB Medium Term Strategy 2016-2019, page 12 as adopted by the AGM

In the context of the German LCP BREF transposition, the EEB suggested the following to be taken by decision makers. The approach was developed in the EEB's 2017 study[18] on mercury and NOx, and on the more recent opinion on the LCP BREF transposition draft national law[19]:

1. In case of continued operation up to 2024 or beyond, all the stricter yearly averaged emission ranges associated with BAT shall apply as emission limit value: SOx 10mg/Nm³, Dust 2mg/Nm³ and Mercury set at 1µg/Nm³ with continuous monitoring;
2. A yearly averaged emission limit value for NOx of 85mg/Nm³ or lower shall be set if plants would operate up to 2024 and beyond (This forces SCR on existing lignite that can cut NOx emissions >95%);
3. The higher BAT performance range for energy efficiency set for "new plants" should be binding as from 2020 (to get rid of the pre-1996 inefficient boilers);
4. A daily-averaged emission limit of not more than 0,1µg/l for water emissions of mercury should be implemented based on BAT and the no-deterioration principle set in the Water Framework Directive, the Minamata Convention and 2017 LCP BREF findings.

3.1.3 Possible compromise (negotiated on case by case)

In case of better balance between the public and operator's interests a derogation option to demand 1+2 (of the basic demands mentioned in previous section 3.1.2) could be considered, provided that retrofits are necessary. In this case, the operator might require guarantees on "return on investments".

a) If the lignite power plant will **definitely close** by [2024][20], an upper limit of 150mg/Nm³ for NOx and 3µg for mercury could be agreed with the public concerned, which would mean low-cost DeNox techniques and no further mercury abatement investments for many plants that currently comply with the IED. For hardcoal-fired power plants, there is no technical justification for these relaxations because SCR has been considered a standard technique since the 2006 BREF (and confirmed as BAT in the revised LCP BREF);

b) As an alternative to demanding 1+2 (of section 3.1.2. basic demands), a system similar to the IED limited lifetime derogation could be considered in exchange of a reduced operation as from 2020, which is foreseen in the 2017 LCP BREF with two sub-options:

Sub-option 1) forced "peak load" operation below 1,000/1,500 h/year (including the CHP and all the hardcoal plants). However, 1,500 hours is too much for hard coal plants or for lignite fired CHP. In these cases, the LCP BREF allows lenient air pollution standards that would not require retrofits;

Sub-option 2) A limited lifetime operation of max 17,500 hours and up until [2024/2030] under the better middle of the BREF range, or (a given IED ELVs if the lignite plant definitely closes by then. The year 2024[21] is chosen because consistent with IED (Art 33), applied in the context of 2017 LCP BREF compliance. The start date of July 2020 is consistent with climate targets, the end of the TNP derogation, and the fact that the 4 years (August 2021) is a maximum compliance deadline for 2017

[18] https://eeb.org/library/mercury-emissions-from-coal-power-plants-in-germany-de/
[19] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/08/EEB-submission-to-German-draft-law-implementing-the-2017-LCP-BREF.pdf
[20] Another end date may be considered as more "reasonable" by national NGOs depending on local conditions e.g. plant serving public district heating, genuine security of supply concerns…
[21] Ibid

LCP BREF compliance. A longer end date could only be negotiated for lignite-fired power plants that are used for grid stability or that can substantiate "security of supply"/workers concern. Hard coal plants should be an easy fight because their operation is uneconomic, and they run on imported fuels. What counts is the operating hour's quota.

Operators need to be aware that NGOs can use their rights to challenge unsatisfactory decisions through Art 15.4 / 21 IED permit review (mandatory NGO public participation procedure), or use various tools if no 'fairer' deal is negotiated. **A fair deal means that operators are not buying time, but a real trade-off within conflicting interests is to be negotiated.**

c) If either of the derogations above are applied, the operator should be liable in case of derogations to compensate for all associated external damage costs. The operator should in any case be required to pay a "health protection contribution". The amount of the contribution should be staggered in accordance to the environmental performance of the plant under the derogation mode. Generated money could be allocated in a sort of Energy Transition Fund. The external damage costs factors set by the European Environmental Agency (EEA)[22] could be used and would give an indication on the adequacy of levels set for the levies or taxes on air pollutants that should be established (e.g. French *Taxe Générale sur les Activités Polluantes*, Norwegian NOx charge). The finance minister should be pleased about that suggestion, which is fully consistent with the polluter pays principle. A competitive bidding procedure or tender, where part or all of generated revenues could be re-injected into the energy transition, even to the utilities that own coal generators if they offer better alternatives, would increase the chance such a system is accepted by the concerned industry.

d) For plants older than 36 Years in 2021 the continued operation or retrofit would not make any sense from the perspectives of age (inefficiency), climate objectives and overall bad environmental performance. In these cases, retrofitting is clearly a stranded investment and the plants should be retired.

4 Issue #2: Policy demands on air pollutants (based on BAT)

4.1 NOx: problem

These contribute to acidification and eutrophication of waters and soils and are known precursors of particulate matter formation and ground-level ozone. Of the chemical species that comprise NOx, it is NO_2 that causes adverse effects on health (airway inflammation and reduced lung function). **LCPs** (solid and liquid fired) **are the largest point source emitters of NOx** in the EU, totalling on average 55% of all combined air emissions of the large-scale industrial sectors, which corresponds to a reported 970K tonnes put into the environment[23]. NOx emissions are higher for hard coal compared to lignite combustion due to difference in combustion temperatures, however lignite plants do not use full potential of abatement options available.

[22] See "Costs of air pollution from European industrial facilities 2008-2012", EEA Technical report No 20/2014 https://www.eea.europa.eu/publications/costs-of-air-pollution-2008-2012

[23] 2017 PRTR air emissions data, reported by operators

The indicative damage costs (health) of one tonne NOx emitted in the EU range from 1,696€ in Malta to 24,442€ in Austria[24].

4.1.1 NOx pollution levels to request (>300MWth)

The revised BREF explicitly recognises that, for fluidised bed combustion (FBC) boilers burning coal and/or lignite, or the lignite-fired pulverised coal (PC) boilers, the levels of <85mg/Nm³ "*are achievable when using SCR*".

Revised LCP BREF:

- 175 mg/Nm^3 (yearly average) for lignite and FBC hard coal boilers
- 150 mg/Nm^3 (yearly average) for PC hardcoal boilers.
- Lower BAT-AEL range: 65mg/Nm^3 for hardcoal and <85mg/Nm³ for lignite PC if Selective Catalytic Reduction (SCR) is used.

Position of the EEB:

- The yearly upper BAT-AEL for existing (lignite PC and FBC lignite and hardcoal) plants should be 100 mg/$Nm^{3,}$, the daily upper BAT-AEL should be 160 mg/Nm^3;
- The yearly upper BAT-AEL for existing hard coal plants should be 85 mg/Nm3, daily upper BAT-AEL 140 mg/Nm3.

Position of the authors:

- <85mg/Nm³ for any lignite plant operating up to 2025 or beyond. If the lignite plant is due to close by 2024 or takes a limited lifetime up to 17,500 hours, then an upper level of 150mg/Nm³ could be considered as a trade-off because it would mean that the lower cost SNCR could meet those levels
- Hard coal plants could immediately meet the levels of 65mg/Nm³ since it is expected they already have SCR fitted - the operators are just not required to use the abatement to its potential due to laxist pollution limits.

SCR is a clearly established BAT, and the levels achieved with those techniques should therefore be enforced in existing plants irrespective of what level the revised BREF would allow. It is then up to the permit writer to set the level of abatement required. This is an established standard for hard coal plants due to the 2006 LCP BREF (200mg/Nm³ upper level set), that was supposed to be met latest in 2008, although many member states provided derogations. Hardcoal plants can achieve levels of 50mg/Nm³ with this technique or even lower, if the abatement potential is utilised in a meaningful manner. A well-operated SCR achieves 80-**95**% NOx reduction.

For lignite plants, this technique was not yet required in the EU and just primary measures allowed the operators to stay below the 200mg/Nm^3 emission limit. So far there is only one EU lignite plant[25] equipped with this technique, and it can technically achieve emission levels of around 46mg/Nm³. If an operator wishes to keep its plant open for more than 5 years (up to 2025 and beyond), then the stricter

[24] 2005 prices, EEA NO20/2014 report based on Value of Statistical Life (VSL)

[25] The Slovenian Sostanj 6

BAT-AEL should be required as the maximum permissible emission limit i.e. 85mg/Nm³ (yearly average). Those levels correspond to the implementation of SCR and are cost proportionate when considering the avoided damage costs of NOx pollution.

For more arguments in relation to NOx, cost and benefit figures please refer to the EEB's detailed SNCR briefing[26] published alongside this report.

The lowest emission levels reported with SCR in combination with primary measure range from:

Hardcoal: 14,4 mg/Nm³ (China), 53,4 mg/Nm³ (US), 66 mg/Nm3 (NL/DK)

Lignite: 47 mg/Nm³ (China), 60,6 mg/Nm³ (US), >125 mg/Nm³ (EU, but no SCR)

TPP Sostanj 6 → managed down to 46 mg in testing mode one day

4.2 Dust: problem

Dust refers to Particulate Matter (PM) that is especially harmful for human health. It can penetrate deep into the respiratory system and causes cardiovascular and lung diseases, as well as cancer. Secondary PM is also formed through release of precursor gases (e.g. SO_2, NOx, and NH_3).

LCPs (solid and liquid fired) are the largest point source emitters of PM in the EU, accounting for 47% of all combined air emissions of the large-scale industrial sectors, which corresponds to a reported 39K tonnes released into the environment every year[27]. The indicative health damage costs of one tonne of dust emitted in the EU range from 14,917€ in Cyprus to 170,702€ in Belgium[28].

4.2.1 Pollution level to request (dust) >300MWth

Revised LCP BREF:

- 8 mg/Nm³ (yearly average) >1,000MWth, derogation up to 14mg/Nm³ (daily averaged) possible for <1,500 hours per year;
- 10 mg/Nm³ (yearly average) 300-1,000MWth, with derogation up to 12 (yearly) possible, 20 (daily average) for plants <1,500hours per year

Position of the EEB:

The common techniques used to abate dust in EU coal/lignite LCPs are electrostatic precipitators (ESP) or fabric filters (FF) -also called 'baghouse' or 'bag filters'- in combination with (wet) scrubbers. The revised BAT levels (2-8mg/Nm³) leave full option of choice to operators of existing plants but also for new plants (2-5mg/Nm³) since well-maintained ESP can reach levels below 5mg/Nm³ without problems.

[26] Specific NOx briefing, EEB,2020
[27] 2017 PRTR air emissions data, reported by operators
[28] EEA 2005 prices, VSL

Levels below 3.5 mg/Nm³ should correspond to operation in accordance to BAT for existing plants and <2mg/Nm³ for new plants. This can be achieved also for existing ESP. Most plants would have to upgrade their ESPs (e.g. by installing additional electric fields) or consider installing an FF as a "police filter".

The lowest emission levels reported for dust emissions (2010) by existing LCPs by member states are:

Hardcoal: 1.62-5 mg/Nm³ with fabric filter in combination with wet FGD or 1-2.88 mg/Nm³ with an ESP in combination with wet FGD

Lignite: 0.8-1.3 mg/Nm³ with an ESP in combination with wet FGD

4.3 SOx: problems

SO_2 contributes to acidification with significant impacts on aquatic ecosystems and forests. In case of high concentrations, it can affect airway function and cause inflammation of the respiratory tract. It further contributes to formation of PM in the atmosphere.

LCPs are the largest source emitters of SOx in the EU, in 2017 exceeding 1.2 million tonnes counting for 69% (all fuels)[29]. Annual benefits of moving for stricter standards are highest for this pollutant, estimated as €4,326million per year of avoidable external health damage cost[30].

The indicative health damage costs of one tonne of SOx emitted in the EU ranges from 2,270€ in Cyprus to 74,414€ in the Netherlands.

4.3.1 Pollution levels to request (SOx)

Revised LCP BREF:

- 130 mg/Nm3 (yearly average) for pulverised combustion, up to 220mg/Nm³ (daily) possible for plants operating <1,500 hours per year;
- 180 mg/Nm3 (yearly average) for fluidised bed combustion, up to 220mg/Nm³ (daily) possible for plants operating <1,500 hours per year;
- As alternative to above, lignite fired LCPs >3,00MWth can for 'techno -economic' reasons apply a desulphurisation rate of >97% combined with maximum ELV of 320mg/Nm³ (yearly) for existing FGD systems and apply a desulphurisation rate of >99% combined with maximum ELV of 200mg/Nm³ (yearly) for "new" FGD systems[31].

Position of the EEB:

[29] 2017 PRTR air emissions data, reported by operators

[30] EEB/GP Health report May 2015 https://eeb.org/library/health-and-economic-impacts-of-alternative-emission-limits-for-coal-power-plants-in-the-eu/

[31] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503383091262&uri=CELEX%3A32017D1442

- The general case for existing coal and lignite plants should be differentiated according to fuel (sulphur content). The general case for existing lignite plants should be further differentiated according to fuel Sulphur (S) content: 1% S and 1-3.25% S dry weight

  – lignite: 130 mg/Nm3 (yearly average) for plants burning fuels up to 1-3.25% S, 205 mg/Nm3 (daily average)

  – hard coal/lignite: 40 mg/Nm3 (yearly average) for plants burning fuels <1% S, 75mg/Nm³ (daily averaged) for plants burning fuels <1% S

- Prohibition of burning fuels with S content higher than 3.25% (beyond FGD design)

- The yearly upper SO2 level for existing hardcoal plants should be 40 mg/Nm^3, daily averaged upper level should be 75 mg/Nm^3

Position of the authors:

Emissions are strongly correlated with the sulphur content of the fuel (‘*what comes in gets out somewhere*’). Fuel choice, i.e. to not fire fuels with Sulphur (S) content higher than 0.1% weight/weight, is therefore to be considered as a primary measure for abatement of SOx. The highest S contents are Bulgarian lignite’s, which may exceed 5% S (dry).

There are several abatement options for coal/lignite LCPs, the most common and effective one besides fuel choice is wet Flue Gas Desulphurisation (wFGD), which should be required in all cases. Variations of sorbent injections and spray dry scrubber/absorbers (SDA) are promoted by the industry as alternative, cheaper techniques. Furthermore, there are additional techniques not mentioned in the 2017 LCP BREF, such as the GORE™ Modules, which bring SO_2 reduction as a co-benefit, and can be installed in an existing scrubber.

The revised BREF foresees a level of 10-130mg/Nm³ (yearly average) for pulverised combustion and 20-180mg/Nm³ for fluidised bed boilers. These huge ranges indicate explicit favouring of the status quo for fluidised bed boilers to not invest in wetFGD (the 180 level covers the 2009-built Polish hard coal Tauron Lagisza fluidised bed boiler which operates with sorbents injection only). However, a footnote recognises that 20mg/Nm³ could be achieved through a “*high efficiency wet FGD system*” which should be fought for during permitting procedures.

The second, broader issue is that the ranges set in the BREF do not differentiate in accordance to S content in fuels, but rather according to boiler type. This makes no sense in terms of an outcome-driven approach to set benchmarking for SOx removal and may have dramatic effects for the majority of hardcoal plants that operate well below 100 mg/Nm3 or even lignite plants combusting lower sulphur content (<1%S), which could be very much tempted to “fill up” their emissions by lowering the wet FGD unit performance.

It is clear that the 130mg/Nm³ (yearly) is achieved with Sulphur content up to 3.5% S (dry) with an average SO2 removal efficiency of the wet FGD unit at 98.5%. Much lower can be achieved through further upgrades of the wet FGD unit (additional trays) and/or fuel blending and/or by adding another wet FGD unit in line. **It is not a matter of technical nature, but economic feasibility.**

Based on the above points, the following pollution levels should be set:

- The maximum level of 10mg/Nm³ should be required for any coal/lignite plant emitting above a certain load of SO2 per year e.g. 30 tonnes;
- A desulphurization rate derogation should not be accepted, because this would relate to burning lignite fuels which have extreme Sulphur levels of 3% or even beyond. These fuels are beyond wet FGD specifications, and burning these types of fuels without prior Sulphur removal/blending cannot be a BAT under any circumstances.

The lowest emission levels reported on SO2 range from:

Hardcoal (with sulphur content <1%dry): 3 mg/Nm³ (US), 9 mg/Nm³ (DK), 21-91 mg/Nm³ (EU/DK+DE+IT+AT)

Hardcoal (with sulphur content >1%dry): 113 mg/Nm³ (EU/PL)

Lignite (with sulphur content <1%dry): 21-77 mg/Nm³ (EU/DE)

Lignite (with sulphur content >1%dry): 106-122 mg/Nm³ (EU/CZ+EL)

Lowest emission levels reported on SO2 range from:

Hardcoal (with Sulphur content <1%dry): 3mg/Nm³ (US) , 9/Nm³ (DK), 21-91mg/Nm³ (EU/DK+DE+IT+AT)

Hardcoal (with Sulphur content >1%dry): 113/Nm³ (EU/PL)

Lignite (with Sulphur content <1%dry): 21 -77mg/Nm³ (EU/DE)

Lignite (with Sulphur content >1%-3.5dry): 106-122mg/Nm³ (EU/CZ +EL)

4.4 Heavy metals (focus mercury): problems

LCPs emit a large amount of heavy metals. The main pollutants are mercury, arsenic, cadmium, chromium, lead and nickel. These are emitted directly into the air and to water (as well as indirectly through wastewater treatment plants, and/or bioaccumulation in soils). These substances are recognised as persistent, bio-accumulative, and toxic. In the European Union, each year 200,000 babies are born with mercury levels that are harmful to their mental and neurological development[32]. LCPs (predominately coal-fired) are the largest point source emitters of mercury in the EU, totalling on average 61% of all combined air emissions of the large-scale industrial sectors, which corresponds to an average reported 15,6 tonnes emitted into the environment[33].

Whilst many heavy metals (e.g. arsenic, cadmium, chromium, lead and nickel) are captured as a co-benefit of dust and SOx controls (ESP, FF and wet FGD), a special focus is made on a non-regulated hazardous pollutant which is mercury, which has come in the spotlight of public attention.

Coal combustion releases mercury in oxidised (Hg2+), elemental (Hg0) or particulate bound (Hgp) form. Mercury is present in the coal (on average 0.2mg/kg dry coal), the combustion process releases this into

[32] http://www.ehjournal.net/content/12/1/3

[33] 2017 PRTR air emissions data, reported by operators

the exhaust gas as elemental mercury. It may then be oxidised via homogeneous (gas-gas) or heterogeneous (gas-solid) reactions. The mercury which is adsorbed onto solid surfaces is known as particulate-bound mercury. Oxidised mercury is more prevalent in the flue-gas from bituminous coal combustion, and it is relatively easy to capture using SO2 controls, such as wetFGD, because it is water soluble. Particulate-bound mercury is also relatively easy to capture in existing particulate control devices. However elemental mercury -which has a long lifetime and can therefore be transported over long distances- is more prevalent in the flue-gases of lignite and sub-bituminous coal combustion, and hardly captured with existing pollution controls.

4.4.1 Pollution levels to request (mercury)

Revised LCP BREF:

- 7 µg/Nm3 (yearly average) for lignite fired LCPs
- 4 µg/Nm³ (yearly average) for hardcoal fired LCPs
- It is explicitly recognised that a **level below 1µg/Nm³ (yearly average) can be achieved for both fuels with specific mercury abatement techniques**.

EEB Position:

- The yearly upper BATAEL for existing hard coal plants <300 MWth should be 3.5 µg/Nm³
- The yearly upper BATAEL for existing hard coal plants >300 MWth should be 1.5 µg/Nm³
- The yearly upper BATAEL for existing lignite plants <300 MWth should be 3.5 µg/Nm³
- The yearly upper BATAEL for existing lignite plants >300 MWth should be 3 µg/Nm³
- The level of 1µg/Nm³ is confirmed to constitute BAT for both fuels, where dedicated mercury abatement techniques are implemented (as specified in the footnote).

Position of the authors:

A level of 1µg/Nm³ (yearly averaged) corresponds to levels achieved with BAT.

EU plants show that levels of <3µg/Nm³ (lignite) and <1.5µg/Nm³ (hard coal) are already achievable through well-maintained controls as co-benefit only. The revised LCP BREF has resulted in a bad compromise where the footnote for each BAT range states that <1µg/Nm³ is achievable through the use of BAT while still providing for very high upper ranges, which correspond to currently observed levels through co-benefit of traditional controls only. It is worth to highlight that the BAT/BEP guidance document for coal combustion developed under the Minamata Convention has confirmed that the BAT level for air emissions is <1µg/Nm³ and even 0.5µg/Nm³ for lignite fired LCPs[34].

Even though no dedicated mercury abatement techniques have been implemented in the EU with the IED, the revised BREF sets dedicated BAT-AELs on mercury for coal/lignite and for a group of heavy metals when co-incinerating waste in LCPs, emphasizing the importance of mercury emissions control. The lower BAT-AEL range is set at <1µg/Nm³ and would clearly require dedicated mercury controls (chemicals additions, enhanced SCR, injecting powered Activated Carbon, fuel change or blending or GORE™ Modules), while the upper BREF range of 7µg/Nm³ for lignite based plants and 4

[34] See section 4.1.3 of UNEP BAT/BEP guidance (2016) on coal fired combustion plants the BAT/BEP guidance document for coal combustion http://www.mercuryconvention.org/Portals/11/documents/forms-guidance/English/BATBEP_coal.pdf

µg/Nm³ for coal based plants can sometimes be met without additional mercury controls; that depends on the mercury input of the fuels and on current technical configurations.

Only a few EU coal/lignite LCPs are implementing dedicated mercury abatement at commercial operating scale for the moment, and some do not have continuous emission monitoring in place. The revised LCP BREF BAT-C, the revised emission limit in Germany (set at 10µg/Nm³ as from 2019), and recent information from technique providers show that levels below 1µg/Nm³ are achievable.

The effectiveness of different techniques depends highly on the chemical characteristics of the coal that is burned. Recent research on LCP's in the EU present excellent results in control of mercury emissions using Fixed Sorbent Catalyst technology (e.g. GORE™ modules – not listed in the revised LCP BREF, but listed as BAT in the more recent Waste Incineration BREF[35]) and in combination with wet FGD achieving levels below 1µg/Nm³. Three pilot scale projects on lignite power plants (two in Poland, Belchatow and Patnow II, and one in Germany, Schkopau) implemented those Sorbent/Catalyst – GORE™ modules. The demonstration/pilot scale projects using the 12 layers of SPC (GORE™ modules), in a Belchatow unit achieved the following results: Hg average inlet concentration 12.1µg/Nm³, Hg average outlet concentration 0.4µg/Nm³ with total abatement efficiency of 96.7%. While it might need up to 12 or more layers of modules to achieve < 1 µg/Nm³, the current LCP BREF limit for lignite plants of 7 µg/Nm³ can usually be met with three or four layers.

The abatement level depends on the number of layers of the modules, each module can capture up to 1kg of mercury, each layer removes between 15-25% of incoming mercury, depending on the gas velocity. The price of this technique varies on many factors e.g. order size, complexity of the project, level of required application engineering, associated warranties). Each layer of modules for a typical >300MWel power plant costs about 5 €/kW Euros in CAPEX, plus the cost for integration which is usually about 50 % of the module cost. There is no OPEX with this technique.

Considering the age profile of EU plants, which tend to be very old, the modules will have an abatement capacity sometimes even exceeding the remaining life span of the plant. An important co-benefit is the SOx abatement, because those modules are placed in the existing scrubber. For the Belchatow example a SOx removal efficiency of 87% with 12 layers of modules was observed (about 15% per layer), 50% with 4 layers. The achievements are in line with the efforts to decrease the mercury in the range of the new LCP's BREF limits and even beyond (less than 1µg/Nm³). The same type of technology is already in use at full commercial scale in US coal plants for more than 5 years due to legislative drivers. In Europe, besides the above-mentioned pilot projects, the technique has been installed in commercial lignite-based power plants in HKW Chemnitz (CHP), Germany, and in Melnik, Czech Republic, and will be installed in two plants in Poland in the near future.

For the HKW Chemnitz plant, only two lawyers of modules have been installed to meet the upper level of the BREF level (7µg/Nm³), however much lower levels could be achieved if required by the permit writer.

What is interesting with this option is that the industry counter-arguments on fuel specificity do not work for this technique: as it would primarily capture elemental mercury but also reduce oxidized mercury, it would not matter what the "input" characteristics of the fuel are.

[35] http://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC113018_WT_Bref.pdf

However, it is very important to remember that the abated mercury (from stack emissions) just doesn't' disappear. It is captured in the modules, wet FGD residues, fly ash so the question remains how to deal with the "sinks" of this pollution flow (considered as hazardous wastes).

4.4.3 Monitoring of mercury emissions to air

It is important that the requirement for continuous monitoring is also rigorously applied with minimum calibration intervals every month, and that data is made available on true emissions. Currently the legal minimum is just one measurement per year, but the revised LCP BREF requires continuous emissions monitoring >300MWth. The LCP BREF also allows as an alternative the semi-continuous trap sampling method, as practiced in the US (see footnote 18 to BAT 4). If continuous trap sampling would be chosen these need to be checked regularly. Lignite plants are more vulnerable for variations in mercury inputs due to higher level of elemental mercury content in the fuels, and therefore need stronger monitoring requirements.

The preferred monitoring is the use of automated monitoring systems (AMS) which carry out continuous emissions monitoring (CEM). However, the BREF allows an alternative semi-continuous monitoring method known as "sorbent traps", which is used a lot in the US.

There is an ongoing debate triggered by industry about not being able to monitor low levels with enough accuracy or the absence of a validated standard, this is in turn used as an excuse to set higher emission limits in the permit because of "measurement uncertainty" or absence of a validated standard for compliance assessment.

The current problem is rather linked to the absence of the official validation of the alternative method of the sorbent trap and a possible misunderstanding of the EN standard.

Background on Automated Monitoring Systems (AMS)

There are various AMS devices which are currently able to monitor continuously emission levels of mercury <10µg/Nm³. The model SICK MERCEM 3000Z is certified according to European Standards (EN) to measure in the 0-4µg range. There are other devices e.g. DURAG HM 1400 TRX + Gasmet Technology Oy CMM hg up to 10µg. The standard deviation from reference methods is just 0,18µg, in compliance with the US sorbent trap calibration tests as practiced in US (PS12 B method 30B), meaning they pass the <20% relative accuracy.

The impact of the uncertainty range issue is due to how the EN standards are set up. The EN standard 15267 states that if the AMS can measure zero, then it should be certified to a value "*no greater than 2.5 times the daily average emission limit value*". For waste incineration this factor is 1.5. It is not clear why these factors have been set up, but this means that in theory **an ELV (daily averaged)** for hg could not be set below 10µg/Nm³ (**daily average**) for mercury emission to air from coal combustion (2.5 x the certification range). However, the **annual** average upper BAT-AEL level for existing plants is 4/7µg for hardcoal/lignite. It is therefore clear that member states can already set a daily averaged ELV for mercury at 10µg. The reason why the AMS need to catch up with being able to measure more accurately and at much lower levels is because, so far, the emission limits have either not been required, or set too high, not requiring high accuracy and capacity to monitor at much lower levels. The BREF reviews will therefore drive progress on monitoring methods.

Sorbent traps method

The sorbent trap method is a semi-continuous type of measurement. The sorbent traps are like tubes with several compartments containing material (glasswool, carbon etc) which are inserted in the chimney and are replaced at short intervals, they require physical interventions at the stack. The traps absorb the mercury which needs to be analysed in each compartment by a lab or a portable device. The accuracy of the standard method is down to 0,1µg. The monitoring of an ELV set at the level of 1µg is possible, however the sorbent trap method is widely accepted – as is the case in the US - but so far not certified (according to EN norms). There are various providers of sorbent Traps (such as Lumex, Thermo Fisher, SA Environment AMESA-M).All those devices have a very high accuracy and can measure down to 1 ng/m3 (0.1 ppt). The SA Environment AMESA M device is certified in the range of 0-5µg/Nm^3, with a Relative Accuracy is 11,86% (+/- 0,28µg).

What if operators wish to derogate from continuous monitoring?

Article 15(4) of the IED refers to emission levels associated with BAT (BAT-AELs), and therefore cannot be derogated from. The EEB objected to the current footnote no 19 in BAT 4 (page 743 in the 2017 LCP BREF), stating that periodic measurements can be set instead "*only each time that a change of the fuel may have an impact on the emissions*" and if "*the emissions levels are proven to be sufficiently stable due to the low mercury content in the fuel*".

First of all, lignite cannot fall in to the category of showing "sufficiently stable" emission levels, due to variations in the mercury, but also to the halogen content in those fuels.

Secondly, the operators need to prove first that the second condition stated above is met (i.e. through continuous monitoring over a longer time period). The EEB provided the view that it is not possible for coal/lignite to guarantee stable hg input basis (which affects emissions profile), especially if the operators do fuel blending (in which case they would have to sample all the time) or do some sewage sludge co-incineration, or another type of co-combustion where fuel input characteristics are not stable (sewage sludge contains heavy metals). The lignite industry often used the fuel variability argument all the time when it suited them, i.e. to oppose stricter mercury limits.

Thirdly, emission levels depend on the abatement made. Normally operators would employ Activated Carbon Injection, addition to boiler or sorbents duct injection and or fuel blending, with halogen additives. There is therefore a self-interest to carry out continuous monitoring in order to optimise costs (optimise hardware implications, injection rates to save costs on chemical additives).

Finally, another reading of this footnote could also mean that it does not replace the continuous monitoring method (AMS-CEM or semi-continuous monitoring method through Sorbent trap method) by periodic measurements, but with an **additional** periodic measurement to take place each time when a fuel change is done.

4.5 Other air pollutants (HF/HCL)

The other main pollutants regulated through the revised LCP BREF are Fluoride (HF) and Hydrogen Chloride (HCl). These pollutants have negative health effects linked to respiratory diseases and eye irritation. HCl and HF transforms to hydrofluoric acid under moisture, which amplifies acidification.

4.5.1 Pollution levels to request (HCl and HF)

Both parameters have implications on the type of SOx abatement for specific plants and are therefore worth highlighting. **This parameter is important to push (expensive) wet FGD and further dust controls on existing plants**, especially for those firing coal with high chlorine content. The Polish delegation lobbied hard for the relaxation of these parameters and managed to get through a footnote allowing 20mg upper HCL level instead of 1-5mg/Nm³ for Fluidised Bed boilers bigger than 100MWth that combust fuels with a chlorine content of >1000mg/kg (dry). In case of secondary FGD (wet or dry FGD, DSI), chlorine and fluorine removal is in the range of 95-99% as a co-benefit. For Fluidised Bed boilers (FB) it is common to apply only Boiler Sorbent Injection (BSI) which achieves much lower chlorine removals in the order of 25-50%.

HCl concentrations in the flue gases of Polish FB boilers, fuelled with Polish hardcoal, are typically 50-500mg/Nm³ (chlorine content >4470mgCl/kg). FB scrubber techniques as used in the US (Luminant/Dominian Energy) could reach levels of 10mg/Nm³ but would mean additional investments.

HF: the level for LCPs >100MWth is set at 3mg/Nm³ with a possibility to go up to 7mg/Nm³ for Circulating FB boilers or wet FGD systems with downstream gas-gas heater. The levels should however not exceed 2mg /Nm³ because of the technical information available and should be forced through the permit review. In fact, the 20mg/Nm³ level corresponds to the power and district heating LCP Dalkia Poznan EC II Karolin (19,74mg/Nm³). Many FB boiler type district heating LCPs are operating above this parameter: e.g. Tauron Katowice at 72.45mg/Nm³, Siersza Power Plant (2001) at 380mg/Nm³.

The level proposed in the revised LCP BREF would require secondary emission controls such as expensive wet FGD or DSI because of this parameter for coals with high chloride content such as certain Polish hard coals. Special anticorrosion material would be needed (meaning outage of plants) or building of a new stack and eventually an addition of a bagfilter. About 1,825MW (4.5% of total installed capacity in Poland) would be affected due to this parameter alone (Lagisza, Elcho, Siersza, Katowice, Bielsko Biala Bielsko Północ, Jaworzno 2, Zeran, Tychy and Zofiówka under construction). The Czech plant Detmarovice would also be affected by this parameter. We therefore would expect the operators of those plants to attempt to get away with derogations on that parameter as well, with serious implications for SO2 and dust emissions and economic viability (wet FGD is expensive but effective to co-capture those pollutants).

HF: Several plants exceed this parameter, especially in Spain. Many plants in the UK have not reported on this parameter and should be checked, since these are based on estimates only.

5 Issue #3: Protecting water (good chemical and ecological status) and water savings

EU LCPs reported an annual direct release of 1,667 kg of mercury in 2012, which is the biggest single source among industry emitters (26.84%). However, the true figure is significantly higher due to reporting thresholds, and to the fact that operators often outsource pollution treatment to Municipal Waste Water Treatment Plants (MWWTP) funded with taxpayers' money – this is referred to as "indirect discharge". A study[36] reveals serious concern of a threefold increase of mercury concentrations in surface water. Mercury is a persistent, bioaccumulative and toxic pollutant that must be phased out under the EU Water Framework Directive. The objective is to achieve zero emissions of mercury from anthropogenic sources.

Techniques can be implemented by the operator, that would have to significantly reduce mercury discharge through the waste water in line with what is required to meet environmental quality standards, if European decision makers were serious about implementing the pollution prevention at source and the polluter pays principles. The EU Water Framework Directive, with its daughter directive (the Environmental Quality Directive – EQS 2013/39/EU), is quite a powerful tool since it establishes a phase out emission objective for Priority Hazardous Substances (PHS), and a progressive reduction obligation for Priority Substances (PS). These pollutants are addressed in this section since the obligations apply irrespective of site-specific considerations and there is a general "no deterioration" principle. *Although these principles and objectives relate to the air pathway / air-soil pathway the section below only addresses the direct water release pathway.*

A second water issue of high environmental impact is **water consumption**. Thermal power plants require a massive amount of water for their cooling towers, and a 2014 report by the wind energy association found that thermal electricity generation (including nuclear power) is responsible for the largest water use for industrial and agricultural activities (44%). Estimates for coal LCPs depend on the cooling type, but are in the range of 1.7-2m³/MWh, which would make up around 1.54 Billion m³ for 2011[37]. *Greenpeace will report on this aspect for EU coal LCPS in 2020.*

Many techniques exist to prevent or reduce the volume of contaminated wastewater discharge with regard to these pollutants. Some are listed in the revised BREF, e.g. water recycling, evaporation and dry bottom ash handling. However, these lack clear parameters in terms of volumes of water consumed/kWh output. Especially – but not only - in German lignite plants, wastewater from wet flue-gas cleaning is used for ash stabilisation, or surplus wastewater from ash cooling is used in cooling tower after treatment. The main question remains how robust the stabilisation of ash is, since ash is full of contaminants such as heavy metals, and in Germany this is used for back-filling (in essence, disguised landfilling). However, proponents state that this prevents diffuse emissions during transportation of ash on conveyor belts.

5.1.1 Vulnerabilities and proposals for action

There is a lack of legal clarity about timescales and the meaning of the PHS and PS phase out obligations in the Water Framework Directive and Environmental Quality Standards Directives, but the objectives are clear[38]: There is an explicit obligation under the IED (Article 18) to ensure the Environmental Quality Standards (EQS) are met, even if that means **requirements to go beyond BAT**. This obligation is easier to implement for stopping new coal projects rather than addressing existing sources, but should

[36] Carl H. Lamborg et al. (2014): A global ocean inventory of anthropogenic mercury based on water column measurements. Nature 512:65–68

[37] EWEA March 2014 report "Saving water with wind energy", see page 10 and 11, figures from Special Report on RES and Climate Change Mitigation of 2011

[38] See Article Peter Kremer "The prohibition of mercury discharges from coal-fired power stations under European Law " 2013, Journal of European Environmental Planning Law

nevertheless be used, especially since the requirements are in force since 7 January 2014 for existing LCPs.

Mercury is a vulnerable parameter because the biota (normally relating to prey fish) limit values set in the EQS Directive are quite tight (20µg/kg) and are exceeded in many countries. It is worth noting that the revised EQS Directive has introduced new maximum allowable concentrations (MAC) values for LCP relevant pollutants e.g. for nickel and lead. This should trigger permit reviews in accordance to Article 21(5) point (c) in combination with Article 14(1) point (a) of the IED. This would open the door to tightening on all the other water pollutants as listed above.

Zero liquid discharge is technically possible, as is routine for waste incineration plants. The evaporation technique consists of transferring water to the gas phase using heat in vapour-compression evaporation systems. The water vapour is condensed and may be reused after treatment. It needs then further treatment prior to disposal (landfill).

6 Issue #4: Energy Efficiency

6.1 General background BAT

EU decision makers decided that the EU ETS Directive should be the sole instrument regulating GHG, and that preventing GHG emissions should be founded on a "market-based instrument", emissions trading. The provision in Article 26 of the EU-ETS[39], now in IED Article 9(1) of the IED, foresees that permit writers would not be allowed to include in the permit an ELVs on a GHG "*unless necessary to ensure that no significant local pollution is caused*". However, as clarified in Recital 10, it is entirely possible for member states to set more stringent protective measures such as GHG requirements, when it comes to enforcement.

The IED sets the general principle that "energy is used efficiently" as provided in Art 11(f). Energy efficiency is therefore logically part of the benchmarking process, i.e. the BAT on energy efficiency is set in the BREF. However, a provision that was introduced through the EU ETS Directive provides that **the permit writer is not obliged to set minimum energy efficiency benchmarks** through the permits (Art 9(2)). However, a few member states do implement these as minimum requirements. Operators have a self-interest to run their plants as efficiently as possible, also in terms of fuel use, since this makes up the largest share of operation costs.

EEB demands:

Studies from the US EPA submitted by the EEB indicate that existing plants can reach an increase of energy performance of up to 8%, if combinations of the various techniques for improving energy efficiency are implemented (e.g. boiler or turbine related improvement, double reheat, design of critical piping etc). An improvement of **at least 3 percentage points** should be realised.

[39] Article 26 of the EU ETS Directive 2003/87/EC of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC; OJEU L275; 25.10.2003 consolidated version of 25.06.2009. The EU-ETS Directive amended the IPPC Directive in such a way to exclude CO2 from the list of pollutants to be regulated on a BAT –based approach.

Minimal energy efficiency levels associated with BAT (BAT-AEEL) should be considered as binding. Contrary to other BREF documents, those levels have a special status on the revised LCP BREF and are not labelled "indicative" hence should be considered as binding. The state of the art for >600MWth is set at the level of 42% net electrical efficiencies (lignite boilers) and 46% (hard coal boilers).

Furthermore, the EEB proposes to implement an emission performance factor (EPF) that would combine market-based instruments with command and control type (BAT) based regulatory frameworks. The EPF would be applied to any minimum carbon price floors and the EU ETS allowance price for the applicable reference year for the Energy Supply Industry. The EPF would be calculated on the basis of the "low carbon" fossil fuel energy generation route reference baseline, for coal/lignite that would be 320g CO_2eq/KWh net output achieved by 'state of the art' natural gas fired CCGTs. The operators in the Energy Supply industry would have to apply their current rate of CO_2 emissions/KWh net output and divide by the reference base performance factor (i.e. 320g CO2eq/KWh). The sum – the EPF – is multiplied by the minimum carbon price (EUA). The EPF would therefore ensure that operators that chose a carbon-intensive, badly performing generation type will contribute more. The operators of CCGT operating in accordance with state-of-the-art standards on efficiency would just pay the regular carbon price level. In any case, the EPF should not discount biomass fractions in case of co-firing with coal.

An annual increase of the EPF by +1 or more could also be considered if progress is not meeting expectations. In this case, the desired minimum carbon price floor could be achieved by a politically set target year for the coal generators, even for the operators of hard coal plants that upgraded to the economically and technically viable efficiency performance BAT levels (45-46%). At the same time the EPF would discourage the use of sub-standard gas generators.

The Formula could look as follows: **EPF =** $(n - 2018) + \frac{EP\ actual\ (xg\ CO2\ eq/KWh)}{EP\ ref\ base(320g\ CO2\ eq/KWh)}$

EPF = Emission Performance Factor; N= Reference year the EPF applies to; EP actual: CO_2 emissions performance of the boiler in Xg CO_2eq/KWh; EP ref base: Reference base of "low carbon" fossil fuel energy generation i.e. CO_2 emissions performance of state of the art baseload CCGT (320g CO_2eq/KWh)

7 Issue #5: Lignite mining related issues

7.1 General background environmental problems linked to mining

Coal mining has a broad range of impacts on the environment, including emissions to air, soil, and water, as well as emission from transfer. in addition, mines directly affect wildlife, causing habitat loss and habitat fragmentation.

1 billion tons of lignite were produced in 2016 worldwide, with most of the production happeing in Europe, China and Russia[40]. According the European Association for Coal and Lignite, in the year 2014 the share of 'Coal and Lignite' category in the total extraction of mineral resources for EU-28 represented the second largest run-of-mine, accounting for approximately 13% (507 Mt) of the total EU extraction. Power generation companies are the largest consumers of lignite in the EU, using 90% to 95% of the whole production[41].

[40] BGR Energy study, 2017

[41] European Lignite Mines Benchmarking Sanitized Report, 2014

The list of possible pollutants and detailed information on thresholds for coal mining are given in the Annex II of the EU PRTR Regulation.

7.2 Vulnerabilities and proposals for action

Estimates of emissions of pollutants to air, water and soil should be reported for each substance that triggers a threshold. Beside the direct emissions from combustion (stacks), the use of lignite results in fugitive emissions from mining activities, including excavation, transport and treatment of the lignite, disposal of non-combustible ash and pollution residues remaining after combustion.

The major air emission from coal mining is fugitive dust, the PM10 and PM2.5 component of dust, followed by TSP, Non-Methane Volatile Organic Compounds (NMVOCs), trace metals and others. Mining activities impact water and soil trough the formation of Acid Mine Drainage (AMD), Total dissolved substances (TDS), Total suspended solids (TSS), as well as consumption and water abstraction.

EEB demands:

TSP/PM fugitive air emissions from lignite coal mining operations are currently not measured. For the quantification of fugitive emissions, emission factors are required as input data. Therefore, a unification of the methodology used to quantify fugitive emissions from mining remains one of the main challenges for research.

The study “Standardized emissions inventory methodology for open pit mining areas” was carried out to establish a standardized TSP and PM10 emission inventory. The proposed methodology was applied to seven mining companies operating in the northern part of Colombia. The study found that, on average, a mine company generates respectively 0.726 kg of TSP and 0.180 kg of PM10 per ton of coal produced, using 1.148 m^2 for every ton of coal produced per year.

A dedicated briefing with mining-related arguments is published separately to this briefing[42].

8 Taking action on plants: where to find information and what next?

The critical time windows under the IED are:

- From 2017 to July 2020, due to linear decrease of the Transitional National Plan derogation, in particular for the NOx parameter and SO_2 parameter (high sulphur coals/lignite);
- From 2017 to August 2021, due to revised BREF-related upgrades (mainly air parameters for mercury, SO2, NOx and dust on a case by case basis for coal/lignite combustion). For water related pollutants, e.g. mercury, nickel and lead, permit reviews also depend on the chemical status of receiving waters).

In those countries having General Binding Rules (GBR) in place and where coal/lignite fired power plants are operational (e.g. BE, DE, FR, FIN, NL), the national rules would have to be reviewed to be consistent with the BAT-AELs (in practice, they transpose 1:1). In accordance to general environmental protection policy principles, member states can always provide for stricter requirements (“gold-plating”), but not the opposite. This is when NGOs can push for tighter standards that would apply to all utilities and could

[42] It will be made available on the following website http://eipie.eu/projects

support the energy transition. E.g. Germany will have to tighten its upper limits on dust, NOx and Hg in the 13. BImSchV. However, the German government is taking a 1:1 laxist implementation approach. The EEB provided its comment on the draft Glaw transposing the 2017 LCP BREF in July 2020[43].

In December 2018 the European Environmental Agency published the briefing 'Greening the power sector: benefits of an ambitious implementation of Europe's environment and climate policies'. In relation to the BREF's ELV ranges, the briefing explicitly states that: "*The lower limit is the level of ambition that member states should strive for when setting permit conditions*"[44]

In general, most decisions would have to be taken at least 3 years ahead for advanced planning (e.g. for planned shutdowns and construction works) and regulatory purposes (respect of permitting/administrative procedures). The development phase for contractual arrangements with technique suppliers could take 2 to 6 months. Public procurement laws (public tender) would take 5 to 12 months or longer in case of any challenge. Environmental Impact Assessment procedures and permitting for construction works could take an additional 8 months, depending on national administrative laws, so at least 1 to 2 years would be required prior to the beginning of any construction works. This relative time pressure linked to risk of legal challenges is useful to stifle investment uncertainty. Specific divestment campaigns combined with legal challenges with primary aim to delay projects need to hit at an early stage and throughout the process.

Background information on the current and envisaged technical and environmental performance of existing LCPs can be found through various routes:

1) **Check the NGO Coal database,** coordinated by the Europe Beyond Coal Secretariat

2) **Check the Industrial plant data viewer for LCPs, released by the EEB in September 2020[45]**

   This database will list all the applied derogations under Chapter III and aims to provide for various impact calculation scenarios. It also aims to highlight land grab and water related information.

   It is important that third parties provide up to date information on whether an Art 15.4 IED derogation has been applied, and summary information on substance. For that purpose, please use the format downloadable on sharepoint at this link, and send back the filled version to industrydatabase@eeb.org. If you have further information on abatement techniques used or up to date continuous emissions monitoring data, please provide that information too via the contribution tool on the website, or send it by email with the LCP ID reference code.

3) Check out the detailed coal/lignite plant data from the 'Lifting EU's Dark Cloud report' with the externalised costs, and whether a Chapter III derogation has been taken[46].

[43] https://eeb.org/library/eeb-submission-to-german-draft-law-implementing-the-2017-lcp-bref/
[44] https://www.eea.europa.eu/themes/industry/industrial-pollution-in-europe/benefits-of-an-ambitious-implementation
[45] http://eipie.eu/projects/ipdv
[46] https://eeb.org/library/full-plant-results-lifting-europes-dark-cloud-report/

4) Check whether a permit review is ongoing for your target plant. Article 24 of the IED requires that certain information is available online, however many member states do not have a proper system in place. See the EEB's 'Burning: The Evidence' report for more information[47].

5) Overhauls related stoppages and planned shutdowns of LCPs would normally need to be communicated and agreed by the Transmission System Operator (TSO) in advance. A simple way to get up to date information is to regularly check with the TSO on what the plans are for each installation.

If you wish to target specific plants and seek support, please do not hesitate to contact us.

Contacts:

Goran.Kovacevik@eeb.org and Jaikrishna.r@eeb.org (technical)

Christian.Schaible@eeb.org and Riccardo.Nigro@eeb.org (wider LCP and mine related campaign)

[47] https://eeb.org/publications/61/industrial-production/47539/burning-the-evidence.pdf

9 Abbreviations

ACI Activated Carbon Injection

AMD Acid Mine Drainage

AMS Automated Monitoring Systems

BAT Best Available Techniques

BAT-AEL Emission levels associated with the BAT

BATC Commission Implementing Decision establishing BAT conclusions, under Directive 2010/75/EU of the European Parliament and of the Council

BREF BAT Reference Document

BSI Boiler Sorbent Injection

CAN Climate Action Network

CBA Cost Benefit Analysis

CCGT Combined Cycle Gas Turbine

CEM Continuous Emissions Monitoring

CHP Combined Heat and Power

DSI Duct Sorbent Injection

EEA European Environmental Agency

EEB European Environmental Bureau

EIA Environmental Impact Assessment

ELV Emission Limit Value

EPF Emission Performance Factor

EQS Environmental Quality Standards

ESP Electrostatic Precipitators

EU European Union

ETS Energy Trade System

FBC Fluidized Bed Combustion

FGD Flue Gas Desulphurization

FF Fabric Filters

GHG Green House Gas

HCl Hydrogen Chloride

HF Hydrogen Fluoride

IED Industrial Emissions Directive (2010/75/EU)

LCP Large Combustion Plants

MAC Maximum Allowable Concentrations

MS EU Member State

MWth Mega Watt Thermal

NGO Non-Governmental Organization

NMVOC Non-Methane Volatile Organic Compound

NOx Nitrogen Oxides

PC Pulverized Coal Combustion

PHS Priority Hazardous Substances

PM Particulate Matters

SCR Selective Catalytic Reduction

SDA Spray Dry Absorber

SNCR Selective Non-Catalytic Reduction

SOx Sulphur Oxides

TDS Total Dissolved Substances

TNP Transitional National Plan

TSP Total Suspended Particles

TSS Total Suspended Solids

VSL Value of Statistical Life

US EPA United States Environmental Protection Agency