



Best Available Techniques (BAT) for pollution prevention / reduction from coal-fired combustion plants in the context of the European Union Directive on industrial emissions (IED)

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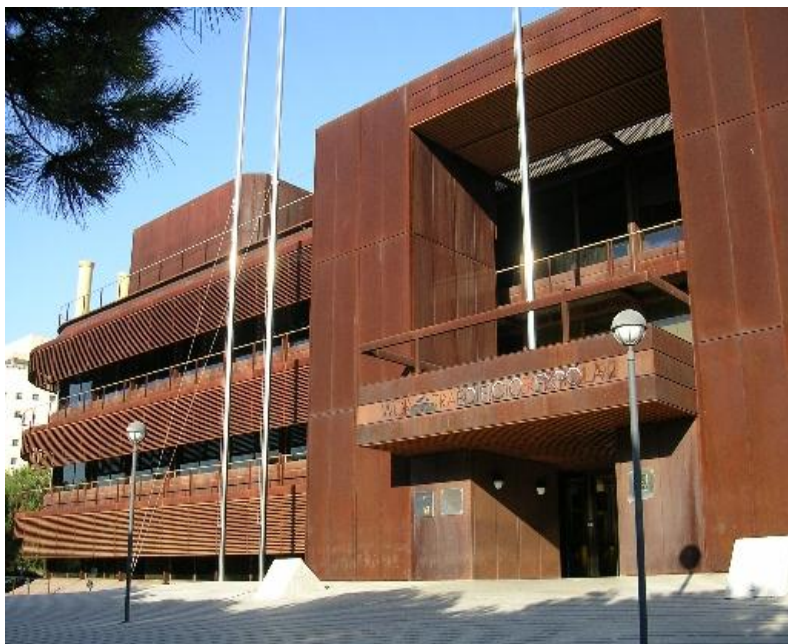
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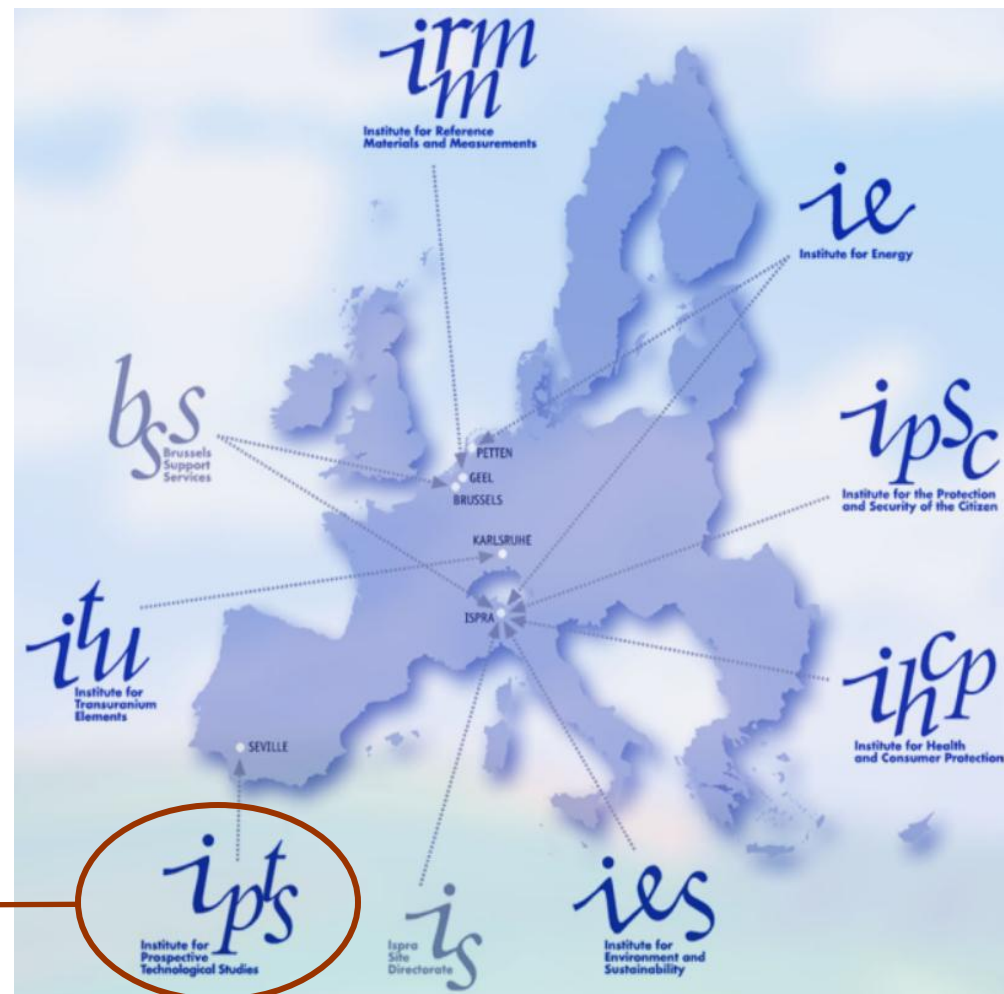
European Commission

IPTS in the context of the Joint Research Centre (JRC) of the European Commission



European IPPC Bureau (EIPPCB)

≅ 20 staff within the Sustainable
Production and Consumption (SPC)
Unit of the Institute for Prospective
Technological Studies (IPTS)



BAT at coal-fired combustion plants in the context of the IED

- ➔ ***Directive on Industrial Emissions (IED) and the Integrated Pollution Prevention and Control (IPPC) Concept***
- ➔ ***Current BATs***
- ➔ ***Review of the Large Combustion Plants (LCP) Best Available Techniques Reference document (BREF)***



IED amends a number of EU legislations concerning industrial emissions

Integrated Pollution Prevention and Control
Directive 2008/1/EC

Titanium dioxide industry
Directives 78/176/EEC, 82/883/EEC and 92/112/EEC

European Pollutant Release and
Transfer Register (E-PRTR)
Regulation 166/2006

VOC emissions from solvents
Directive 1999/13/EC

Waste Incineration
Directive 2000/76/EC

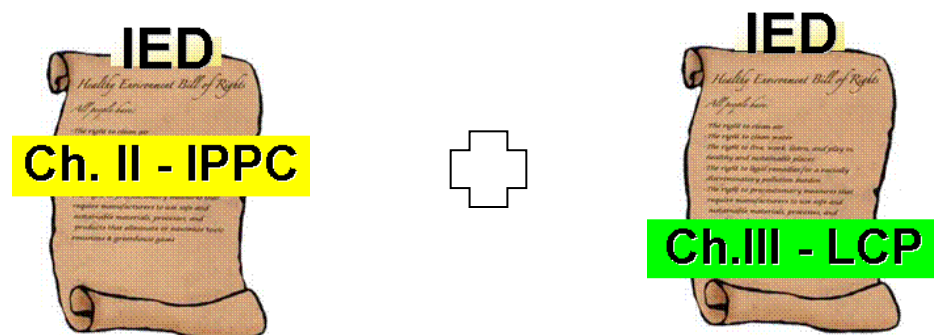
Large Combustion Plants
Directive 2001/80/EC

Industrial Emissions
Directive 2010/75/EU



Large Combustion Plants (> 50 MW_{th}) in the IED: Two aspects of a single regulation

- **IED Chapter II**: Best Available Techniques (BAT) approach (*BAT-associated emission levels*)
- **IED Chapter III**: New Emission limit values (ELVs) and special LCP provisions (Applicable to existing installations from 2016)





IPPC - operating scheme

Prevention and control of pollution
arising from industrial
installations

Industrial Emissions (integrated pollution prevention
and control) Directive

1 legislation

Application of the best available techniques (BAT)
described in BAT reference documents (BREFs)

35 BREFs

BAT-based permit and emission limit values

~ 50 000 installations

Definition of BAT

Best



Most effective in achieving a high general level of **protection** of the environment **as a whole**;

Available



Developed on a scale which allows implementation in the relevant industrial sector, under **economically and technically viable** conditions;

Techniques



Both the technology used and the way in which the installation is **designed, built, maintained, operated and decommissioned**.

Elements in an individual BAT conclusion

Examples:

- Reduce emissions to air
- Minimise water consumption
- Optimise energy consumption
- Prevent soil contamination
- Minimise the use of raw materials

Objective/
environmental
benefit

Environmental performance
associated with BAT
(BAT-AEPLs or BAT-AELs)

42.

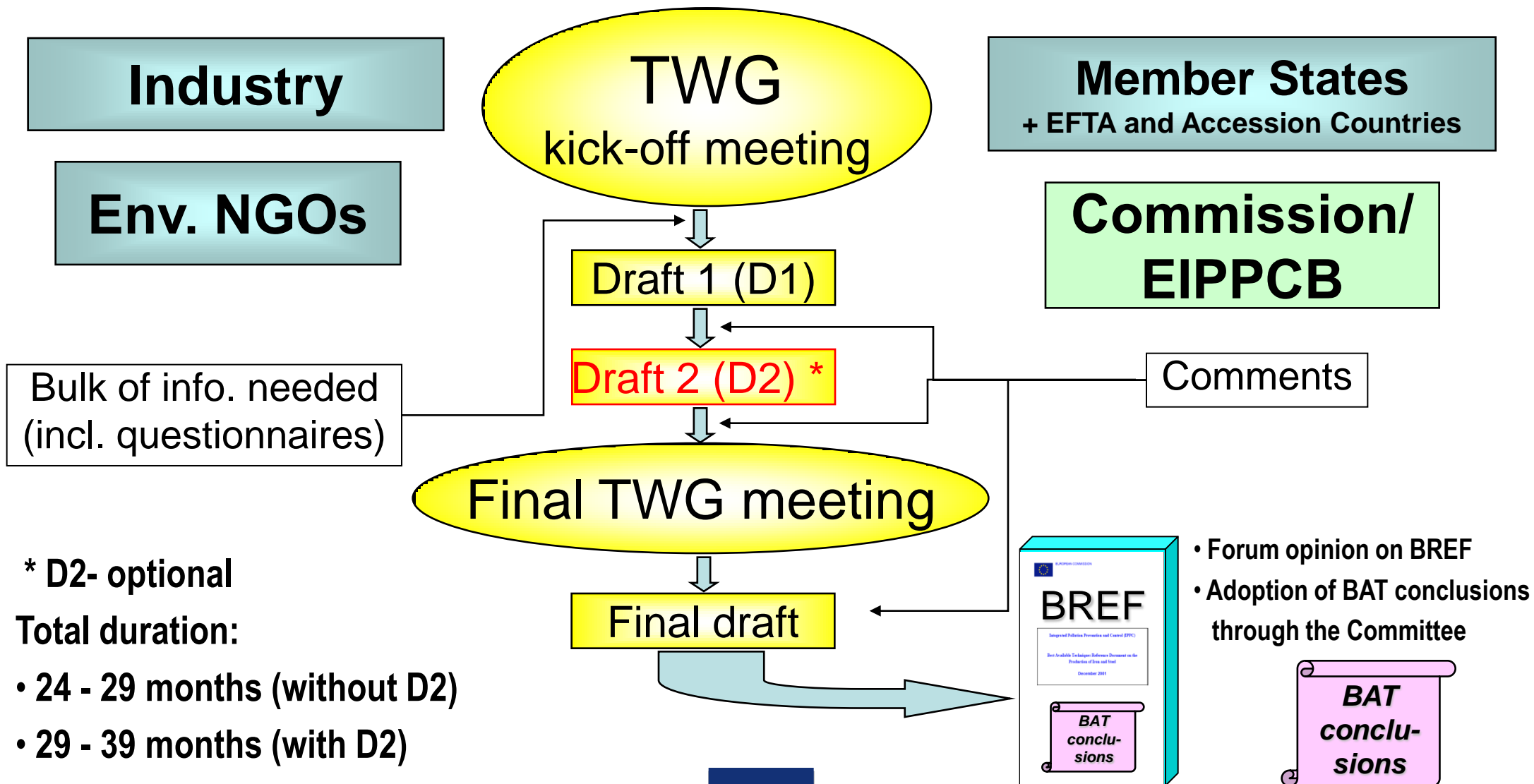
BAT is to:

reduce VOC emissions to 10 – 50 mg/Nm³ as a daily average (by continuous monitoring of emissions) by using the following techniques individually or in combination:

<i>Technique</i>	<i>Description</i>	<i>Applicability</i>
Waste gas incineration	Thermal incineration of organic pollutants with oxidation to CO₂, H₂O, etc.	The technique is generally applicable Not applicable to large waste gas volumes with low VOC concentrations (not economically viable)
Minimising the losses of solvent by ensuring a good sealing of the application system	Optimised design and maintenance of the application system	The technique is generally applicable

Technique(s) to satisfy the objective and meet the performance target

The 'Sevilla process'



Milestones in the review process for the LCP BREF

July 2006	Adoption by the Commission of the current LCP BREF
January 2011	Re-activation of the TWG for the review of the LCP BREF
October 2011	TWG kick-off meeting (Seville): Agreement on the scope of the review and on the key environmental issues (~ 2400 wishes received for the review)
August 2011 to February 2012	Elaboration of a plant-specific questionnaire Workshop held in Brussels in December 2011
May - August 2012	Submission of information by the TWG members and industrial operators
September 2012 – Beginning 2013	Assessment / Drafting period
1 st Quarter 2013	Expected Draft 1 release

Current BATs for coal fired plants - **Dust** *including PM₁₀-PM_{2.5}-partly Hg*



- ➔ *Electrostatic precipitator: removal efficiency > 99,5 %*
- ➔ *Fabric Filter: removal efficiency > 99,95 %*
- ➔ *Co-benefice of FGD for equipped plants (mainly bigger pulverised coal boilers)*
- ➔ *Cyclone & mechanical collectors not BAT – Can be used for pre-cleaning*
- ➔ *Associated emissions (plants > 300MW_{th}): from **5 to 20 mg/Nm³** depending on the age of the plant and whether they are fitted or not with an FGD for SO_x removal*

Current BATs for coal fired plants – **Heavy metals:** *including Hg*



- ➔ *Electrostatic precipitator with high dust removal efficiency below 130 °C*
- ➔ *Combination of techniques:*
 - ➔ **Bituminous coal: ESP (50%) + FGD (50%) + SCR (60%) to reach 90 % Hg removal efficiency**
 - ➔ **Coal of less quality (Sub-bituminous coal and lignite): 30-70 % Hg removal efficiency**

Current BATs for coal fired plants – SO₂ (1/2)



➔ *Low sulphur fuel in combination with:*

➔ *For pulverised coal-lignite boilers:*

- ➔ Wet scrubber (>100 MW_{th}) 85-98% removal efficiency / Co-benefit HCl-HF removal (98-99% removal efficiency) and Dust/Heavy Metal removal / Saleable gypsum by-product
- ➔ Spray dry scrubber 80-92% removal efficiency
- ➔ Dry sorbent injection (<250 MW_{th}) 70-90% removal efficiency
- ➔ Seawater scrubber
- ➔ Other techniques such as activated carbon+DESNOX process
- ➔ Natural desulphurisation with low quality lignites having low sulphur and high alkaline ash content (removal efficiency up to 90%)
- ➔ **Associated emissions (>300 MW_{th}): 20-150 mg/Nm³ for new plants and 20-200 mg/Nm³ for existing plants**

Current BATs for coal fired plants – SO_2 (2/2)



➤ *Low sulphur fuel in combination with:*

➤ *Fluidised bed boilers:*

➤ Boiler limestone injection - Reaction S with Ca/Mg added to the bed – Fuels with S content 1-3%

➤ For CFCB: removal efficiency 80-95%

➤ For Fuels with S-content 4-6%: Boiler limestone injection + FGD

➤ For BFCB: removal efficiency 55-65% - Not enough as BAT – Additional FGD needed

➤ Associated emissions ($>300\text{MW}_{\text{th}}$): **100-200 mg/Nm³** for CFCB and PFCB / **20-150 mg/Nm³** for new BFCB and **20-200 mg/Nm³** for existing BFCB (fitted with FGD)

Current BATs for coal fired plants – NO_x (1/2)



➤ *Pulverised coal boilers:*

- Combination primary and secondary measures
- SCR: removal efficiency 80-95%
- Associated emissions (>300 MW_{th}): **90-150** (90-200 for existing plants) **mg/Nm³**

➤ *Pulverised lignite boilers:*

- Primary measures: Low NO_x burners, Flue-Gas-Recirculation, Air Staging (OFA), etc.
- SCR may be applied additionally
- Associated emissions (>300 MW_{th}): **50-200 mg/Nm³**
- Retrofit to Low NO_x burners / OFA can be limited due to boiler size – Application of modern swirl burners are BAT (equivalent flame length)
- SNCR additional technique for small boilers with stable load & fuel quality

Current BATs for coal fired plants – **NO_x** (2/2)



➤ *Fluidised Bed boilers:*

- Air/Fuel staging
- Low combustion temperature (< 900°C)
- Associated emissions:(>300 MW_{th}): **50-150** (50-200 for existing plants) **mg/Nm³**

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The LCP BREF review

Scope: Combustion in installations with total rated thermal input of 50 MW

Fuels considered:

- ➔ **Primary solid fuels (coal, lignite, peat, oil shale)**
- ➔ **Biomass (grass, straw, vegetable waste, etc.)**
- ➔ **Primary liquid fuels (heavy and light fuel oils)**
- ➔ **Gaseous fuels (natural gas, liquefied gas, biogas, hydrogen and syngas)**
- ➔ **Industry-specific fuels (from Chemical, Iron and Steel, Pulp and Paper industries in so far as they are not yet covered by other BREFs)**
- ➔ **Waste (used in co-incineration process).**

The LCP BREF review

Key environmental issues



➔ Air emissions

- ➔ NO_x, CO, SO₂, dust emissions - *Not CO₂ (Regulated through European Trading Scheme ETS)*
- ➔ Other emissions e.g. heavy metals, dioxins and furans, VOCs, PAHs, HCl, Hf are assessed

➔ Water emissions (mainly from FGD plants)

➔ Residues – By-products

➔ Energy Efficiency

Data collection – LCP BREF review Crucial in the BAT approach under IED

➤ The information on key environmental issues is obtained through **a plant-specific questionnaire**, including:

- emissions to air and water
- generation of solid by-product, residues and wastes
- efficient energy use
- techniques potentially candidates for BAT
- contextual information.



■ **+500 questionnaires received - ~ 130 for coal or lignite fired plants**

➤ Other Information is derived from reports, scientific articles, technical information, case studies and environmental permits provided by the TWG (**'Bulk information'**).

■ **225 documents + several text revision proposals received**

Structure of the revised LCP BREF

- ➔ *Preface*
- ➔ *Scope*
- 1. *General information*
- 2. *Common processes / techniques for energy generation*
- 3. *Common processes / techniques to prevent / reduce emissions and consumptions*
- 4. *Gasification / Liquefaction / Pyrolysis of fuels*
- 5. *Combustion of solid fuels*
- 6. *Combustion of liquid fuels*
- 7. *Combustion of gaseous fuels*
- 8. *Multi-fuel combustion and waste co-incineration*
- 9. *Emerging techniques*
- 10. *BAT conclusions for the sector*
- 11. *Concluding remarks*
- ➔ *References*
- ➔ *Glossary*
- ➔ *Annexes*



→ *different fuels*
→ *different fuels*
→ *different fuels*
→ *different fuels*

Applied processes and techniques (+examples)
Current consumption and emission levels
Candidate BAT

Thank you for your attention

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