



BEST-AVAILABLE- TECHNIQUES (BAT) PROJECT OF THE OECD

11th TFTEI Annual Meeting
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Objectives of the BAT project

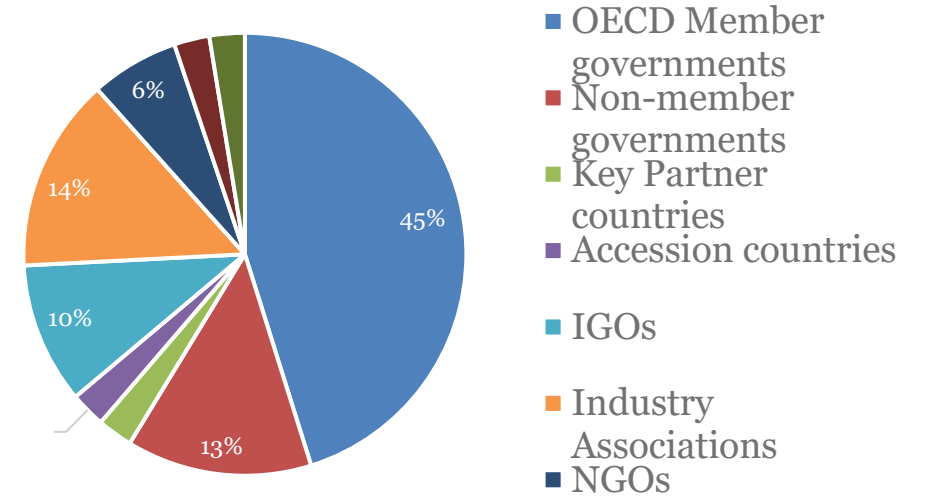
- **Exchange best practices** across countries that already have a BAT-based permitting system
- **Provide guidance** to countries that seek to adopt a BAT-based approach for the first time
- Achieve **progress towards the SDGs**, notably Target 12.4 on the environmentally sound management of chemicals





The OECD Expert Group on BAT

- **Established in 2015**, increased tenfold in size since
- **160 members from 40+ countries and organisations**



- One face-to-face meeting and one interim virtual meeting per year, plus frequent exchanges by email/phone
- **10th meeting of the Expert Group on BAT in 2025**
13-14 November in Seoul, Korea



Deliverables of the OECD's BAT project (2016-2027)



Phase I (2016-2018)

Act.1- Policies on BAT
Across the World (2017)

Act.2 -Approaches to
Establishing BAT Around
the World (2018)

Act.3 - Measuring the
Effectiveness of BAT
Policies (2019)



Phase II (2019-2021)

Act.4 - BAT guidance
document (2020)

Act. 5 - Study on value
chain aspects of
determining BAT (2021)

Act. 6 - Cross-country
comparison of selected
BREFs (Part I)



Phase III (2022-2024)

Act. 7 - Cross-country
comparison of selected
BREFs (Part II)

Act. 8 - Capacity building
workshops

Act.9 - Identifying
innovation and ETs for
potential BAT
determination

Activity 8 - Lessons Learnt



Activity 9 – Innovation and ETs





Phase IV (2025 – 2027)



Act.10 –Role of BAT in Hydrogen production



Act.11 –Recovery of Secondary Raw Materials (SRM) for Resource Optimisation



Act. 12 – Capacity building workshops



Online Resource – [List of BREFs webpage](#)

Country/Organisations

All

Language

All

Sector

All



Country/Organisations	Language	Published/ Last updated year	BREF title	Publisher	Other Information
Flanders, Belgium	dutch	2007	Ceramic industry	The Flemish Centre for Best Available Techniques (VITO)	Under review. The Centre for Best Available Techniques (BAT) is founded by the Flemish Government, and is hosted VITO.
Flanders, Belgium	english	2007	Ceramic industry	The Flemish Centre for Best Available Techniques (VITO)	Under review. The Centre for Best Available Techniques (BAT) is founded by the Flemish Government, and is hosted VITO.
European Union	english	2007	Ceramic Manufacturing Industry	European Commission/JRC	Under review.
US EPA	english	1997	Part: 430 - The pulp, paper and paperboard point source category	United States Environmental Protection Agency	This part applies to any pulp, paper, paperboard mill that discharges or discharge process wastewater pollute to the waters of the United States, or introduces or may introduce process wastewater pollutants into a publicly owned treatment works.
Korea	한국인	2019	Best Available Techniques for Petroleum Refining Industry	Integrated Environmental Permit System (IEPS)	This is the best available technique standard for the petroleum refining industry.

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+

75%

Microsoft Power BI





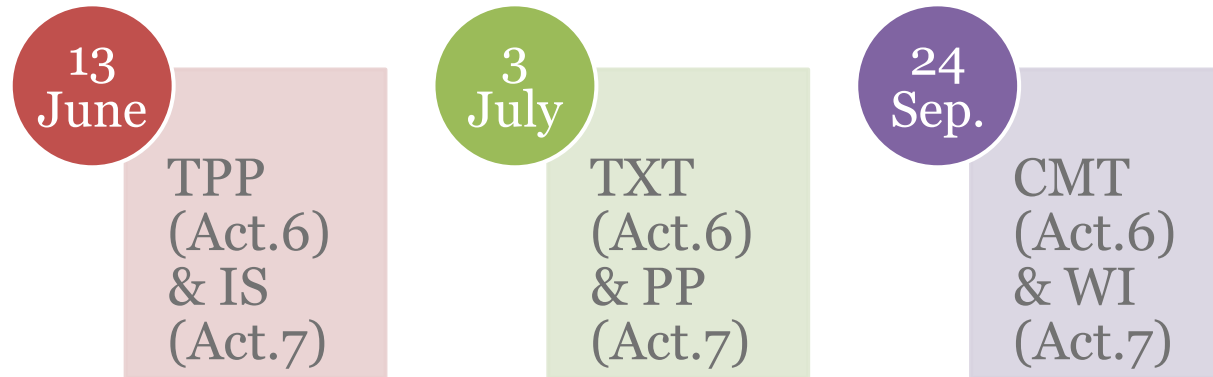
Industrial Pollution Control Webinar Series

Activity 7: Cross Country Analysis of selected BREFs for Iron-Steel, Paper-Pulp and Waste incineration sectors (2024)

Activity 6: Cross Country Analysis of selected BREFs for Thermal Power plants, Cement and Textiles sectors (2022)



Webinar series on BAT





ACTIVITY 7: CROSS COUNTRY ANALYSIS OF SELECTED BREFS FOR IRON-STEEL, PAPER-PULP AND WASTE INCINERATION SECTORS (2024)



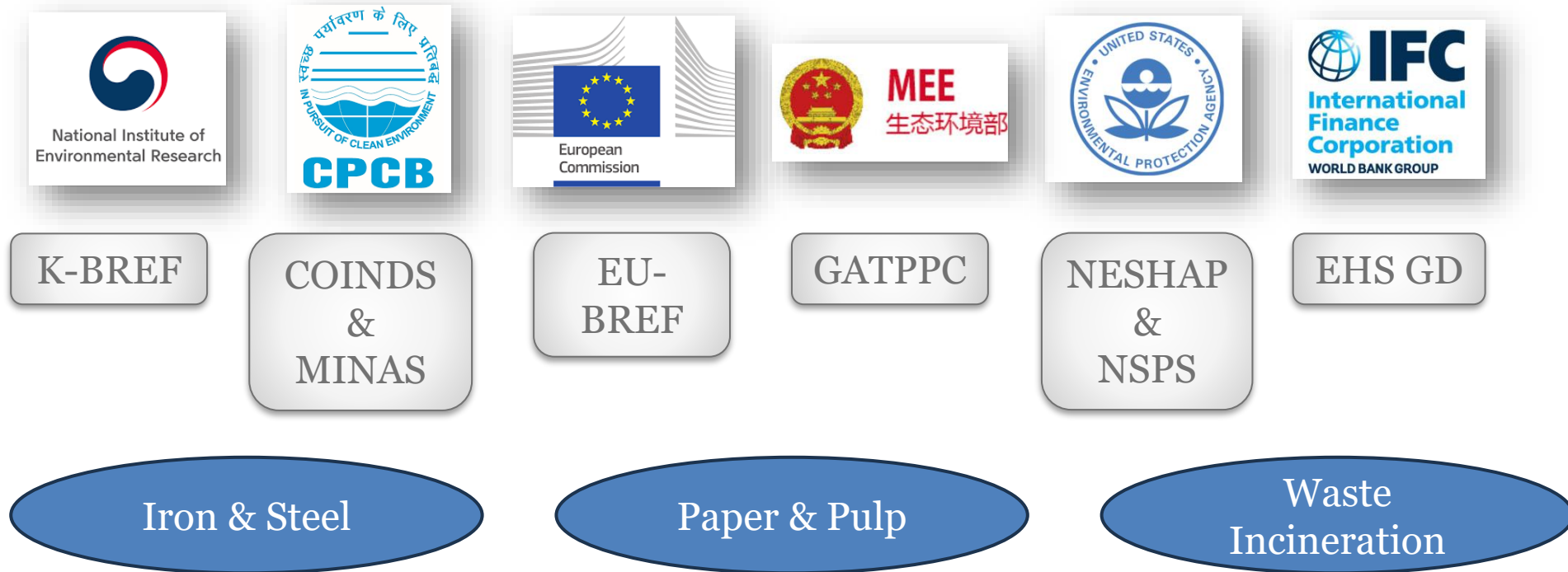
Background

- Governments face a dual challenge:
 - **Tightening industrial regulations.**
 - Achieving **environmental protection & SDGs.**
- Analyse industrial pollution prevention and control techniques across countries
 - BAT and BAT-AELs for three sectors and their key pollutants



Activity 7 – Cross-country analyses of selected BREFs

- Six BREFs/BREF-like





Sectors and Pollutants

Coverage of substances in each **Paper and Pulp BREF**

Substance	BREF
Air emission	
Nitrogen Oxides (NO _x)	EU, World Bank
Sulphur Oxides (SO _x)	EU*, Korea, World Bank*
Dust/PM	EU, Korea, US EPA, India, World Bank
Carbon monoxide (CO)	-
Ammonia (NH ₃), incl. slip	EU
Total reduced sulphur (TRS)	EU*, US EPA, India (only H ₂ S) World Bank
Hazardous Air Pollutant (HAPs)	US EPA
Dioxins and furans	China
Water release	
Total suspended solids (TSS)	China, EU, Korea, US EPA
Chemical oxygen demand (COD)	China, EU, Korea, US EPA
Biochemical oxygen demand (BOD)	China, EU, US EPA, India
Adsorbable organic halides (AOX)	China, EU, US EPA, India
Heavy Metals (zinc, nickel, copper)	Korea, US EPA
Total Nitrogen (TN)	EU, Korea
Total Phosphorus (tot-P)	China, EU
Ammonia	China
Wastewater treatment (wastewater sent to treatment)	China, EU
Water Consumption	China, EU, Korea
Hydrogen Chloride (HCl)	Korea



Iron & Steel



Municipal
Solid Waste
Incineration



KEIs for cross-country analysis

Iron and Steel

Sinter Plants

- Dust,
- NO_x,
- SO_x,
- Hg,
- dioxins

Blast Furnace

- Dust

- Heavy metals
- Cyanide

Electric Arc Furnaces (EAF)

- Dust,
- Hg,
- dioxins

- Heavy metals

Paper and pulp production

Kraft Pulp (Recovery boilers)

- Dust,
- NO_x,
- TRS

- TSS
- COD/TOC
- AOX

Paper manufactured from recycled paper

- TSS
- COD
- AOX
- Tot-N
- Tot-P

Water consumption efficiency

Waste incineration

Municipal Solid Waste Incineration

- Dust,
- NO_x with NH₃ slip,
- Heavy metals (Hg, Cd, tot-metals),
- Dioxins and Furans (PCDD/F)
- Acid gases (HCl, HF, SO₂)



Iron and Steel sector

- **Key pollutants & BAT:**
 - **Air:** NO_x, SO_x, PM, mercury, dioxins.
 - **Water:** Cyanides, lead, zinc.
- **Common BAT:**
 - End-of-pipe: **SCR, ESP, fabric filters.**
 - Process-integrated: Low-NO_x burners, better raw materials.
- **Example:** EU vs. China (GATPPC) BREF shows variation in PM limits due to **measurement standards & technical-economic conditions**



Paper and Pulp sector

- **Key pollutants & BAT:**
 - **Air:** TRS, PM, NO_x from recovery boilers.
 - **Water:** TSS, COD, AOX, nutrients (N, P).
 - **Efficiency measure:** Water use per tonne of product.
- **Common BAT examples:**
 - End-of-pipe: Activated sludge, coagulation.
 - Process-integrated: Water recycling, process optimisation.



Municipal Solid Waste Incineration

- **Key pollutants & BAT:**
 - **Air:** PM, NO_x, NH₃, heavy metals, dioxins, HF, HCl.
- **Common BAT examples:**
 - SCR for NO_x, activated carbon adsorption for mercury/dioxins.
 - Improved combustion control to limit pollutant formation



Common BAT Approaches Across Sectors & Countries

Air emissions:

- SCR (Selective Catalytic Reduction) – NO_x.
- ESP (Electrostatic Precipitators), fabric filters – PM.
- Activated carbon adsorption – Hg, dioxins.

Water releases:

- Activated sludge, coagulation/precipitation – COD, TSS.
- Water Reuse and Closed-Loop Cooling – Efficiency.



BAT-AE(P)Ls - Technical Stringency Variations

BAT-Associated Emission (Performance) Levels

- **NO_x Emissions (mg/Nm³):**
 - EU: 50–150 (SCR) for large boilers
 - US-EPA: ~120–200 (varies by state)
 - China: 100–200 (new plants tighter)
 - India: 300–600 (older plants higher)
- **PM Emissions (mg/Nm³):**
 - EU: 2–10 (ESP/fabric filter)
 - Korea: 5–20
 - India/China (older plants): 30–50

End-of-pipe tech same,
but **performance ranges differ** due to:

- Reference oxygen % variations.
- Averaging period differences (hourly vs daily).
- Plant-specific feasibility.



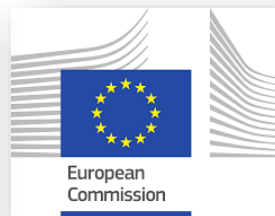
Technical Conclusion

- **Common BAT techniques** are widely recognised, but **BAT-AEL values vary** significantly.
- **Measurement and reference conditions** explain part of the variation.
- **Sector-specific pollutant profiles** influence BAT choices (e.g., dioxins only in waste & steel).
- **Combined approach** (end-of-pipe + process-integrated) yields best results



Why BAT Levels Differ Between Countries ?

- **Legal status** (binding vs. guidance).
- **Economic & technical capacity.**
- **Environmental priorities.**
- **Monitoring & measurement differences** (reference conditions, oxygen levels, averaging periods).





Cross-country Analysis of BAT frameworks

Challenges

- Lack of harmonised BAT-AEL measurement conditions
- Legal and institutional variability across countries
- Limited comparability due to inconsistent documentation

Opportunities

- Standardising monitoring and assessment methods
- Expanding international collaboration and data sharing
- Aligning environmental performance benchmarks globally



I&S
P&P
WI



TPP
CMT
TXT



Any questions or follow-up:

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<https://www.oecd.org/en/topics/sub-issues/monitoring-and-preventing-industrial-pollution.html>