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Review

Best Available Technique assessment methods: a literature review from sector to installation level

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ABSTRACT

The Industrial Emission Directive (IED) has strengthened the requirement to apply Best Available Techniques (BATs) previously introduced by the IPPC (Integrated Pollution Protection and Control) Directive. BATs in the European Union are defined and revised through an official framework: the Sevilla Process. It describes a step-by-step procedure of information exchange among stakeholders supported by data analysis and expert judgements. However, it lacks formal tools, applicable at each step, to support data analysis and the decision process leading to the determination of BATs and BAT-Associated Environmental Performance Levels (BATAPELs). This article is aimed at reviewing the methodological approaches available in the scientific literature since the late 90s for regional or local applications.

This literature review begins with a presentation of the legal context in which the BATs are used, especially under the IED. Then, the methodology used to establish the literature review is detailed; followed by an analysis of the different methods. The outcome is an identification of their objectives, methodological approaches and limits in the case of BAT determination for an industrial sector and the comparison of site performance with identified BATs with a view to selecting techniques adapted to a given installation. From the literature review, seven steps to determine and apply BATs are deduced: (1) Scope and objective definitions; (2) Knowledge of the sector studied to identify key performance indicators; (3) Identification of representative installations; (4) Data collection; (5) Selection of a list of BATs and determination of BATAELs; (6) Site performance analysis and comparison with BATs; (7) Selection of the most appropriate BATs. Finally, this proposition is discussed and perspectives are identified.

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Acronyms: AHP, Analytical Hierarchy Process; ANP, Analytical Network Process; BAT, Best Available Technique; BATAEL, Best Available Technique Associated Emission Level; BATAEPL, Best Available Technique Associated Environmental Performance Level; BREF, BAT Reference document; EIPPCB, European Integrated Pollution Prevention and Control Bureau; EU, European Union; IED, Industrial Emission Directive; IPPC, Integrated Pollution Prevention and Control; L-BAT, Local-BAT; LCA, Life Cycle Assessment; NGO, Non-Governmental Organisation; TWG, Technical Working Group; VITO, Flemish Institute for Technological Research.

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1. Introduction

In 1996, the Integrated Pollution Prevention and Control (IPPC) directive (Council Directive, 1996) introduced the concept of Best Available Technique (BAT) to the European environmental regulation. Since then, applying BATs has become of great importance for the industries concerned and has implied obligations at two levels. On the one hand, the European Commission has had to set out the appropriate process in order to provide sector-specific reference documents describing the BATs. On the other hand, local environmental authorities and operators have had to compare local installation performances with the information contained in these reference documents.

In 2010, the IPPC directive was replaced by the Industrial Emission Directive (IED) (European Commission, 2010) which has extended and reinforced the role of BATs. The industrial sectors concerned with the implementation of BATs are listed in its annex I. This represents about 50,000 installations within in Europe from various industrial sectors (e.g. food, drink and milk; wood-based panels; large combustion plants; or sanitary landfills). The overall goal of the IED is "*to prevent, reduce and as far as possible eliminate pollution arising from industrial activities in compliance with the 'polluter pays' principle and the principle of pollution prevention*". Furthermore, BATs also concern non-IED industries which do not even have the Sevilla Process as a framework; e.g. in the nuclear sector (OSPAR, 2015).

Article 3 of the IED defines "Best Available Technique" as "*the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole*" (European Commission, 2010).

The meaning of each of these three words is important to understand the concept of BAT:

- "Technique" includes both the production "*technology used and the way in which the installation is designed, built, maintained, operated and decommissioned*" (European Commission, 2010). In other words, a technique is not limited to a pollution abatement device but also encompasses management approaches such as environmental management systems.
- "Availability" means the technique considered is "*developed on a scale which allows an implementation in the industrial sector, under economically and technically viable conditions*" (European Commission, 2010). These conditions take into consideration

Table 1
The 12 criteria for selecting Best Available Techniques as stated in annex III of the Industrial Emission Directive.

1	The use of low-waste technology.
2	The use of less hazardous substances.
3	The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate.
4	Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale.
5	Technological advances and changes in scientific knowledge and understanding.
6	The nature, effects and volume of the emission concerned.
7	The commissioning dates for new or existing installations.
8	The length of time needed to introduce the Best Available Technique.
9	The consumption and nature of raw materials (including water) used in the process and energy efficiency.
10	The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it.
11	The need to prevent accidents and to minimise the consequences for the environment.
12	Information published by public international organisations.