

ONDERWERP
BAT from BREF Energy Efficiency (ENE)

DATUM
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AAN
BMS

PROJECTNUMMER
30068215

ONZE REFERENTIE
D10025696:28

BAT list from BREF energy efficiency

Below a summary is presented what BAT from the BREF Energy Efficiency (ENE) are applicable to the development and how these are incorporated.

Number	BAT description	Implemented [Yes/No]	Remark (How, Why not, Alternative)
1	BAT is to implement and adhere to an energy efficiency management system (ENEMS)	• Yes	<ul style="list-style-type: none">• See suggested list in BAT.• BREEAM "very good" standard.• Advanced energy metering of all whole-building energy sources and any individual energy end uses that represent 10% or more of the total annual consumption of the building.
2	BAT is to continuously minimize the environmental impact of an installation by planning actions and investments on an integrated basis and for the short, medium and long term, considering the cost-benefits and cross-media effects.	• Yes	<ul style="list-style-type: none">• The project will be designed and constructed to achieve optimum energy performance while meeting the performance criteria of the facility. The design will strive to utilize the most relevant and economically-feasible technologies to reduce energy consumption and cost, and sustainable design elements will be included and Dutch and EU nZEB regulations.
3	BAT is to identify the aspects of an installation that influence energy efficiency by carrying out an audit. It is important that an audit is coherent with a systems approach (see BAT 7).	• Yes	<ul style="list-style-type: none">• Energy audit will be performed as part of EED. BMS are targeting a BREEAM "Very Good" certification.
4	Audit to identify ENE aspects and options	• Yes	<ul style="list-style-type: none">• See list in BAT.• Energy audit will be performed as part of EED. BMS are targeting a BREEAM "Very Good" certification.
5	BAT is to use appropriate tools or methodologies to assist with identifying	• Yes	<ul style="list-style-type: none">• See list in BAT.

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	and quantifying energy optimization for BAT 4		<ul style="list-style-type: none"> To achieve BREEAM "Very Good" certification, and associated energy efficiency considerations will be incorporated in the overall facility design where possible.
6	BAT is to identify opportunities to optimize energy recovery within the installation, between systems within the installation (see BAT 7) and/or with a third party (or parties)	Yes	<ul style="list-style-type: none"> Outside air economization and exhaust air energy recovery will be included in major HVAC air handling systems to reduce heating and cooling energy consumption
7	BAT is to optimize energy efficiency by taking a systems approach to energy management in the installation.	Yes	<ul style="list-style-type: none"> See list in BAT. Computer controlled systems shall be employed to monitor and control lighting, heating, ventilation and air-conditioning systems to minimize energy usage. Flowmeters and energy metering shall be employed to track energy use and identify any overuse of energy or water consumption.
8	BAT is to establish energy efficiency indicators	Yes	<ul style="list-style-type: none"> Identifying suitable energy efficiency indicators for the installation, and where necessary, individual processes, systems and/or units, and measure their change over time or after the implementation of energy efficiency measures Identifying and recording appropriate boundaries associated with the indicators Identifying and recording factors that can cause variation in the energy efficiency of the relevant process, systems and/or units. Energy efficiency indicators will be through the EED process and as required to achieve a target of "BREEAM "very good" certification.
9	BAT is to carry out systematic and regular comparisons with sector, national or regional benchmarks, where validated data are available.	Yes	<ul style="list-style-type: none"> Energy efficiency indicators will be through the EED process and as required to achieve a target of "BREEAM "very good" certification.
10	BAT is to optimize energy efficiency when planning a new installation, unit or system or a significant upgrade	Yes/No	<ul style="list-style-type: none"> The energy efficient design (EED) should be initiated at the early stages of the conceptual design/basic design phase, even though the planned investments may not be

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			<p>well-defined. The EED should also be taken into account in the tendering process</p> <ul style="list-style-type: none"> • The development and/or selection of energy efficient technologies • Additional data collection may need to be carried out as part of the design project or separately to supplement existing data or fill gaps in knowledge • The EED work should be carried out by an energy expert • The initial mapping of energy consumption should also address which parties in the project organizations influence the future energy consumption, and should optimize the energy efficiency design of the future plant with them. For example, the staff in the (existing) installation who may be responsible for specifying design parameters. • Energy efficiency indicators will be through the EED process and as required to achieve a target of "BREEAM "very good" certification.
11	BAT is to seek to optimize the use of energy between more than one process or system, within the installation or with a third party.	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • The BAT for heating and cooling employ electrically powered heat recovery chillers (HRC) for the generation of heating and cooling water. No fossil fuel is consumed within the building. When HRCs are generating chilled water, instead of rejecting the "waste" energy to the atmosphere (as with traditional chillers) the HRC uses the energy to generate hot water. When the heating demand is greater than the cooling demand the HRC can act as a heat pump to generate hot water using renewable energy from the air. • Domestic hot water is generated from the HRCs as well.
12	BAT is to maintain the impetus of the energy efficiency program by using a variety of techniques.	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • See list in BAT. • Energy optimization will be developed through the EED process and as required to achieve a target of "BREEAM "very good" certification
13	BAT is to maintain expertise in energy efficiency and energy-using systems.	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • See list in BAT.

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			<ul style="list-style-type: none"> Energy optimization will be developed through the EED process and as required to achieve a target of "BREEAM "very good" certification
14	BAT is to ensure that the effective control of processes is implemented by techniques.	• Yes	<ul style="list-style-type: none"> See list in BAT. Energy optimization will be developed through the EED process and as required to achieve a target of "BREEAM "very good" certification.
15	BAT is to carry out maintenance at installations to optimize energy efficiency.	• Yes	<ul style="list-style-type: none"> Clearly allocating responsibility for the planning and execution of maintenance Establishing a structured program for maintenance based on technical descriptions of the equipment, norms, etc. as well as any equipment failures and consequences. Some maintenance activities may be best scheduled for plant shutdown periods Supporting the maintenance program by appropriate record keeping systems and diagnostic testing Identifying from routine maintenance, breakdowns and/or abnormalities possible losses in energy efficiency, or where energy efficiency could be improved Identifying leaks, broken equipment, worn bearings, etc. that affect or control energy usage, and rectifying them at the earliest opportunity. Energy optimization will be developed through the EED process and as required to achieve a target of "BREEAM "very good" certification, which includes the requirement for commissioning and aftercare including maintenance programs.
16	BAT is to establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of operations and activities that can have a significant impact on energy efficiency.	• Yes	<ul style="list-style-type: none"> Energy optimization will be developed through the EED process and as required to achieve a target of "BREEAM "very good" certification, which includes the requirement for commissioning and aftercare including maintenance programs.

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17	BAT is to optimize the energy efficiency of <u>combustion</u> by relevant techniques	Yes	<ul style="list-style-type: none"> • See list in BAT. • See table 4.1 • The facility is being designed to eliminate the use of combustion based energy sources with the exception of back-up power systems.
18	BAT for <u>steam systems</u> is to optimize the energy efficiency by using techniques	Yes	<ul style="list-style-type: none"> • See list in BAT. • See table 4.2 • The facility is being designed to eliminate the use of combustion based energy sources such as boilers. Heater water will be generated from recovered heat from the chiller systems. Any other steam requirements will be via electrical energy sources.
19	BAT is to maintain the efficiency of heat exchangers	Yes	<ul style="list-style-type: none"> • monitoring the efficiency periodically, and • preventing or removing fouling • A maintenance program will be developed for the on-going operation of the facility and ensuring all equipment will be maintained to operate at as close to possible at optimum efficiency.
20	BAT is to seek possibilities for cogeneration, inside and/or outside the installation (with a third party).	Yes	<ul style="list-style-type: none"> • Where co-generation possibilities arise these will be assessed and considered in relation to the operational needs of the facility.
21	BAT is to increase the power factor according to the requirements of the local electricity distributor by using techniques	Yes	<ul style="list-style-type: none"> • See list in BAT. • See table 4.3 • This will be reviewed with the electrical utility provider once they are on-boarded by the project.
22	BAT is to check the power supply for harmonics and apply filters if required	Yes	<ul style="list-style-type: none"> •
23	BAT is to optimize the power supply efficiency by using techniques	Yes	<ul style="list-style-type: none"> • See list in BAT. • See table 4.4
24	BAT is to optimize <u>electric motors</u>	Yes	<ul style="list-style-type: none"> • See list in BAT. • See table 4.5 • Motor efficiencies will exceed ASHRAE Standard 90.1 requirements (premium efficiency motors) or EU equivalent

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			<ul style="list-style-type: none"> The project will specify the use of energy efficient motors and use of variable speed drives through the facility where this provides a measurable energy efficient design
25	BAT is to optimize <u>compressed air</u> systems (CAS)	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> See list in BAT. See table 4.6 Compressed air generation systems will be specified for energy efficient design and will be optimally sized for the required facility capacity.
26	BAT is to optimize <u>pumping systems</u>	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> See table 4.7 in BREF The electric motors used to drive fans and pumps shall be compliant with the latest version of the European Union energy directives to ensure best energy performance. The motors shall include speed control to ensure that fans and pumps are not run at speeds higher than necessary. Fans and ventilation units shall be selected on software that will ensure compliance with the EU Energy Directives.
27	BAT is to optimize heating, ventilation and air conditioning systems	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> See suggested list in BAT. See table 4.8 in BREF Variable flow air and water HVAC systems including Variable Speed Drives on fan and pump motors to reduce system energy usage. Low coil and filter face velocity in HVAC air handling units and low velocity in ductwork to reduce fan energy consumption Demand Controlled Ventilation using CO2 sensing will be provided for high-occupant density spaces to optimize the ventilation air flow Occupied/Unoccupied setback of temperature and minimum ventilation where does not impact on product quality Enhanced indoor air quality including higher air filtration efficiency in HVAC air handling systems and indoor air quality assessment prior to occupancy

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28	BAT is to optimize <u>artificial lighting</u> systems	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • See table 4.9 in BREF • High-efficiency lighting fixtures and lighting control systems less energy consumption vs. baseline similar facilities • LED light sources will be used in all areas. All LED light fittings will be dimmable • Lighting controls shall consist of a combination of the following: <ul style="list-style-type: none"> • Presence detection (on/off) • Absence detection (off only) • Manual dimming switches • Time schedule control • Daylight sensing for daylight harvesting
29	BAT is to optimize <u>drying, separation</u> and concentration processes	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • See table 4.10 in BREF • There are limited systems in the design that fall into this category. All systems within the facility will be commissioned to a high standard and optimized through this process.

Based on above list BAT related to Energy Efficiency have been implemented into the development, are not applicable or have been complied to with alternatives.

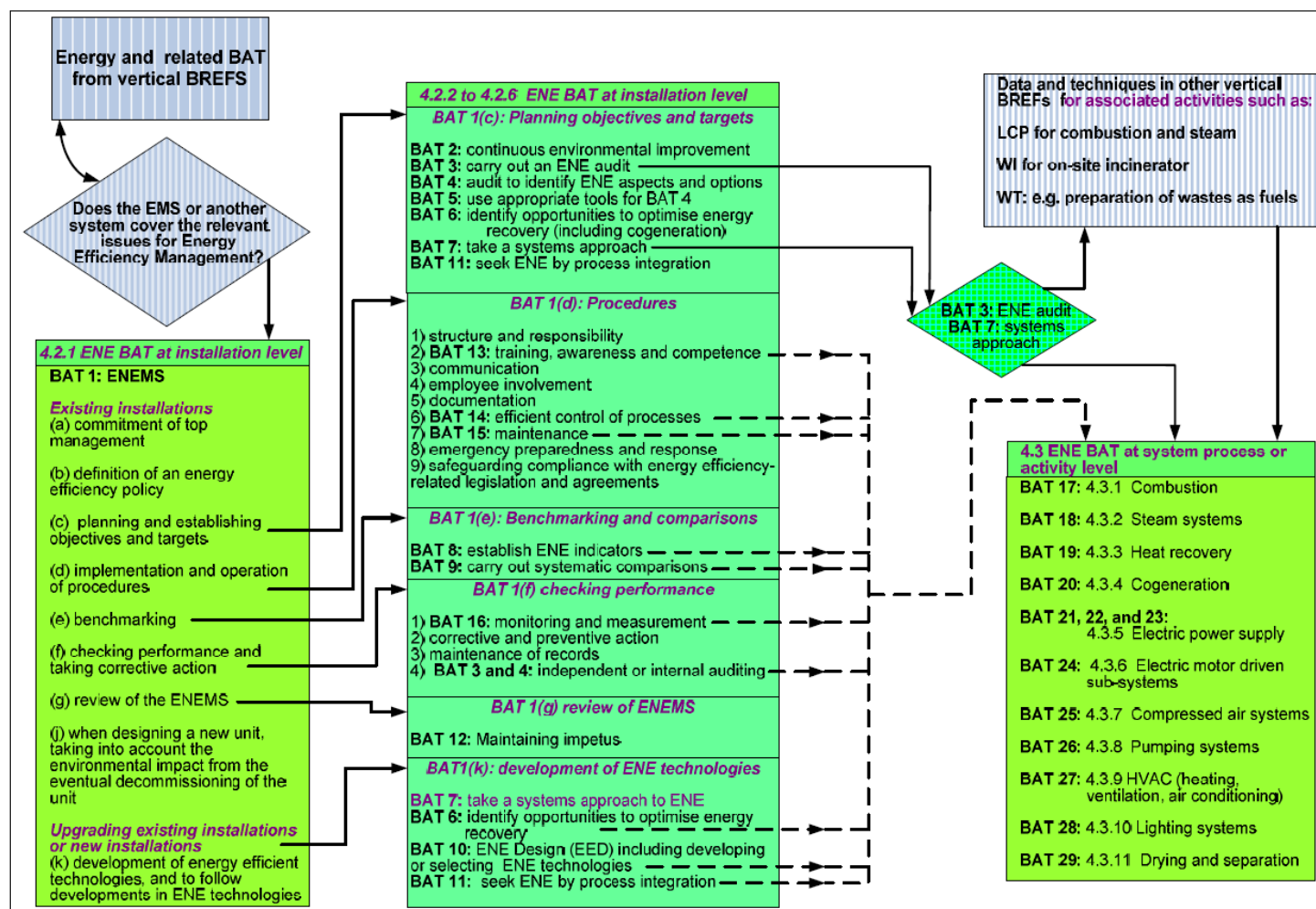


Figure 4.1: Relationships between BAT for Energy efficiency

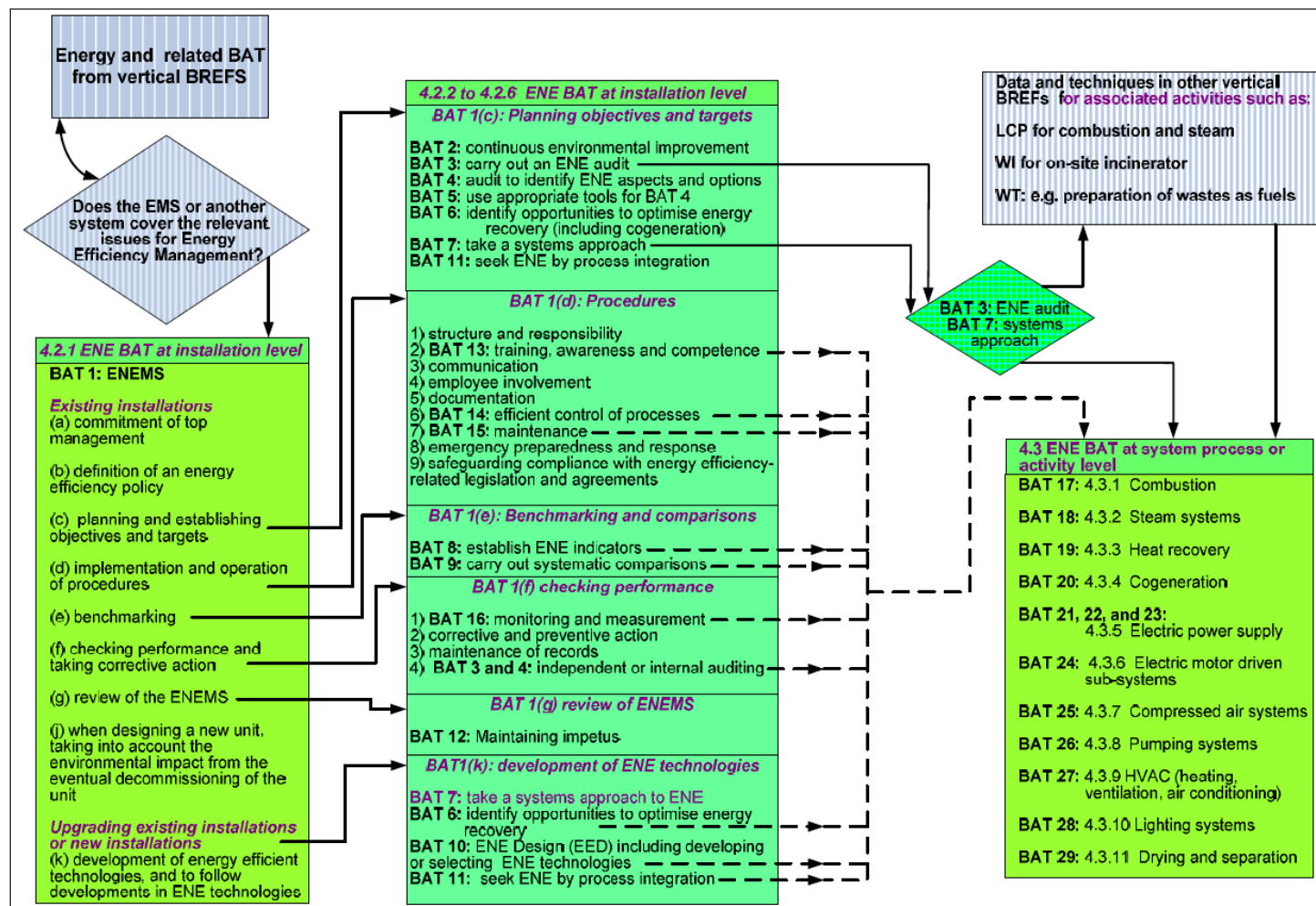


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