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ANNEX 1

ANNEX

Reference document on best environmental management practice, sector environmental performance indicators and benchmarks of excellence for the construction sector under Regulation (EC) No 1221/2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS)

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1. INTRODUCTION

This sectoral reference document (SRD) is based on a detailed scientific and policy report[1] ("Best Practice Report") developed by the Institute for Prospective Technological Studies (IPTS), one of the seven institutes of the European Commission's Joint Research Centre (JRC).

Relevant legal background

The Community eco-management and audit scheme (EMAS) was introduced in 1993, for voluntary participation by organisations, by Council Regulation (EEC) No 1836/93[2]. Subsequently, EMAS has undergone two major revisions:

- Regulation (EC) No 761/2001 of the European Parliament and of the Council[3];
- Regulation (EC) No 1221/2009 of the European Parliament and of the Council.

An important new element of the latest revision, which came into force on 11 January 2010, is Article 46 on the development of SRDs. The SRDs have to include best environmental management practices (BEMPs), environmental performance indicators for the specific sectors and, where appropriate, benchmarks of excellence and rating systems identifying performance levels.

How to understand and use this document

The eco-management and audit scheme (EMAS) is a scheme for voluntary participation by organisations committed to continuous environmental improvement. Within this framework, this SRD provides sector-specific guidance to the construction sector and points out a number of options for improvement as well as best practices.

The document was written by the European Commission using input from stakeholders. A Technical Working Group, comprising experts and stakeholders of the sector, led by the JRC, discussed and ultimately agreed on the best environmental management practices, sector-specific environmental performance indicators and benchmarks of excellence described in this document; these benchmarks in particular were deemed to be representative of the levels of environmental performance that are achieved by the best performing organisations in the sector.

[1] The scientific and policy report is publicly available on the JRC-IPTS website at the following address: http://susproc.jrc.ec.europa.eu/activities/emas/documents/ConstructionSector.pdf. The conclusions on best environmental management practices and their applicability as well as the identified specific environmental performance indicators and the benchmarks of excellence contained in this Sectoral Reference Document are based on the findings documented in the scientific and policy report. All the background information and technical details can be found there.

[2] Council Regulation (EEC) No 1836/93 of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme (OJ L 168, 10.7.1993, p. 1).

[3] Regulation (EC) No 761/2001 of the European Parliament and of the Council of 19 March 2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) (OJ L 114, 24.4.2001, p. 1).

The SRD aims to help and support all organisations that intend to improve their environmental performance by providing ideas and inspiration as well as practical and technical guidance.

The SRD is primarily addressed to organisations that are already registered with EMAS; secondly to organisations that are considering registering with EMAS in the future; and thirdly to all organisations that wish to learn more about best environmental management practices in order to improve their environmental performance. Consequently, the objective of this document is to support all organisations in the construction sector to focus on relevant environmental aspects, both direct and indirect, and to find information on best practices, as well as appropriate sector-specific environmental performance indicators to measure their environmental performance, and benchmarks of excellence.

<u>How SRDs should be taken into account by EMAS registered organisations:</u>

Pursuant to Regulation (EC) No 1221/2009, EMAS registered organisations are to take SRDs into account at two different levels:

(1) When developing and implementing their environmental management system in light of the environmental reviews *(Article 4(1) (b));*

Organisations should use relevant elements of the SRD when defining and reviewing their environmental targets and objectives in accordance with the relevant environmental aspects identified in the environmental review and policy, as well as when deciding on the actions to implement to improve their environmental performance.

(2) When preparing the environmental statement *(Article 4(1) (d) and Article 4(4)).*

(a) Organisations should consider the relevant sector-specific environmental performance indicators in the SRD when choosing the indicators[4] to use for their reporting of environmental performance.

When choosing the set of indicators for reporting, they should take into account the indicators proposed in the corresponding SRD and their relevance with regards to the significant environmental aspects identified by the organisation in its environmental review. Indicators need only be taken into account where relevant to those environmental aspects that are judged as being most significant in the environmental review.

(b) Organisations should mention in the environmental statement how the relevant best environmental management practices and, if available, benchmarks of excellence have been taken into account.

They should describe how relevant best environmental management practices and benchmarks of excellence (which provide an indication of the environmental performance level that is achieved by best performers) were used to identify measures and actions, and possibly to set priorities, to (further) improve their environmental performance. However, implementing best environmental

[4] According to Annex IV (B.e.) of the EMAS Regulation, the environmental statement shall contain "*a summary of the data available on the performance of the organisation against its environmental objectives and targets with respect to its significant environmental impacts. Reporting shall be on the core indicators and on <u>other relevant existing environmental performance indicators</u> as set out in Section C"*. Annex IV - Section C states that "*each organisation shall also report annually on its performance relating to the more specific environmental aspects as identified in its environmental statement and, where available, take account of sectoral reference documents as referred to in Article 46.*"

management practices or meeting the identified benchmarks of excellence is not mandatory, because the voluntary character of EMAS leaves the assessment of the feasibility of the benchmarks and of the implementation of the best practices, in terms of costs and benefits, to the organisations themselves.

Similarly to environmental performance indicators, the relevance and applicability of the best environmental management practices and benchmarks of excellence should be assessed by the organisation according to the significant environmental aspects identified by the organisation in its environmental review, as well as technical and financial aspects.

Elements of SRDs (indicators, BEMPs or benchmarks of excellence) not considered relevant with regards to the significant environmental aspects identified by the organisation in its environmental review should not be reported or described in the environmental statement.

EMAS participation is an ongoing process. Every time an organisation plans to improve its environmental performance (and reviews its environmental performance) it shall consult the SRD on specific topics to find inspiration about which issues to tackle next in a step-wise approach.

EMAS environmental verifiers shall check if and how the SRD was taken into account by the organisation when preparing its environmental statement (Article 18(5) (d) of Regulation (EC) No 1221/2009).
When undertaking an audit, accredited environmental verifiers will need evidence from the organisation of how the relevant elements of the SRD have been selected in light of the environmental review and taken into account. They shall not check compliance with the described benchmarks of excellence, but they shall verify evidence on how the SRD was used as a guide to identify indicators and proper voluntary measures that the organisation can implement to improve its environmental performance.

Given the voluntary nature of EMAS and SRD, no disproportionate burdens should be put on the organisations to provide such evidence. In particular, verifiers shall not require an individual justification for each of the best practices, sector-specific environmental performance indicators and benchmarks of excellence which are mentioned in the SRD and not considered relevant by the organisation in the light of its environmental review. Nevertheless, they could suggest relevant additional elements for the organisation to take into account in the future as further evidence of its commitment to continuous performance improvement.

Structure of the sectoral reference document

This document consists of four chapters. Chapter 1 introduces EMAS' legal background and describes how to use this document, while Chapter 2 defines the scope of this SRD. Chapter 3 briefly describes the different best environmental management practices (BEMPs)[5] together with information on their applicability, in general as well as at SME level. When specific environmental performance indicators and benchmarks of excellence could be formulated for

5 A detailed description of each of the best practices, with practical guidance on how to implement them, is available in the "Best Practice Report" published by the JRC and available on-line at http://susproc.jrc.ec.europa.eu/activities/emas/documents/ConstructionSector.pdf . Organisations are invited to consult it if interested to learn more about some of the best practices described in this SRD.

a particular BEMP, these are also given. Some of the indicators and benchmarks are relevant for more than one BEMP and are thus repeated whenever appropriate.

Finally, Chapter 4 presents a comprehensive table with a selection of the most relevant environmental performance indicators, associated explanations and related benchmarks of excellence.

Throughout the document, due to the nature of the sector, best practices are formulated from a building / project perspective. For EMAS registered organisations, best practice and reporting on indicators should therefore be taken into account at the level of a project / site / building or a selection of these within the portfolio of the organisation (indicating which fraction of their annual work those projects represent). The organisation is invited to state whether the level of performance achieved by the selected project(s) is typical for the organisation or if this is an example of best performance achieved by the organisation.

2. SCOPE

This SRD addresses the environmental performance of the activities of the building and construction sector. In this document, the building and construction sector is considered as consisting of companies belonging to the following NACE code divisions (according to the statistical classification of economic activities established by Regulation (EC) No 1893/2006 of the European Parliament and of the Council[6]):

NACE code 41 and 43: construction of buildings and specialised construction activities;

NACE code 71: architectural and engineering activities, technical testing and analysis;

NACE code 68 and 81: real estate activities, services to buildings and landscape activities.

Companies registered in these NACE codes are the target group of this document (Figure 2.1).

6 Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037/90 as well as certain EC Regulations on specific statistical domains (OJ L 393, 30.12.2006, p. 1).

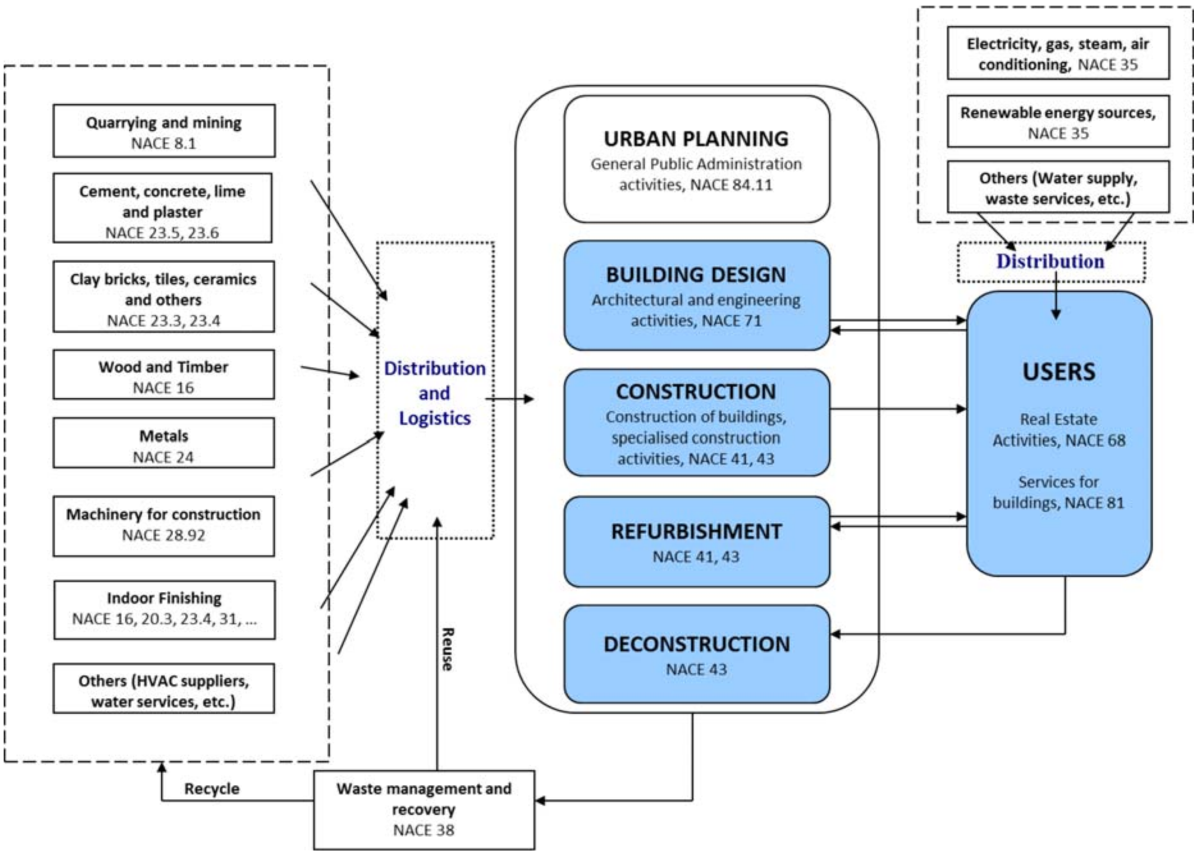

Figure 2.1. Overview of the different actors of the Building and Construction Sector (target group of this document in blue)

In addition, the best environmental management practices identified in this SRD can be of inspiration also for other actors interacting with the organisations above, such as civil engineering works companies, public administrations in charge of urban planning and organisations from other sectors that are going to build, buy or rent a building or contract out services from the construction sector. However, these organisations are not directly targeted by this document.

This SRD is structured according to the different phases of the life cycle of a building (Table 2.1), from building design to the end-of-life of the building and from selection of the best environmentally friendly materials to waste treatment and recycling / reuse cycles. Not all the phases are covered in the same depth. The strategy to select the best environmental management practice in this document is based on the overall environmental impact during design, construction or renovation, the use phase and deconstruction activities.

Table 2.1: Relevant life cycle phases of a building addressed in the different chapters of this SRD and corresponding target group

Chapter / life cycle phase	Description	Target group
3.1 Building design	This chapter covers the best practices that building designers can implement to minimise the environmental impacts of the building / construction project both during construction and, especially, during the use phase. The main environmental aspects considered are energy and	NACE 71

	water use during the use phase and generation of waste both during the construction phase and when the building reaches its end-of-life.	
3.2 Construction products	This chapter provides guidance on the selection of construction products, building elements and materials with lowest overall lifecycle environmental impact. This selection is carried out either by building designers or by the construction companies (depending on the material and on the specific project).	NACE 41, 43, 71
3.3 Construction and renovation	This chapter covers all the activities at the construction site, both for new builds and building renovations. The main environmental aspects addressed are: waste management and materials' use efficiency, water management, dust and noise prevention, energy efficiency on the construction site. In most cases, these BEMPs are also applicable to deconstruction sites.	NACE 41, 43
3.4 Building operation and maintenance	The use phase of a building is the phase with the most important environmental impacts over the overall building lifecycle. Nevertheless, most of these impacts depend on the choices made during the design phase and are thus addressed in Chapter 3.1. However, the role of building management companies and companies providing services for buildings is also relevant. This chapter deals with the best practices these actors can implement in the areas of building management systems and energy optimisation, water management and cleaning practices.	NACE 68, 81
3.5 Building end-of-life	This chapter covers the best practices dealing with buildings having reached their end-of-life, with a focus on selective demolition of buildings with high material recovery rates.	NACE 41, 43

In addition to the building phases described in Table 2.1 and addressed in this SRD, a large potential to improve the environmental performance of buildings lies upstream of those phases, in the realm of public administrations in charge of urban planning. These aspects are covered in the best practice report[7] on which this SRD is based, with best practices on: site selection, land consumption and urban sprawl avoidance; biodiversity protection; urban heat island effect; and water drainage in sealed soils. These best practices are not included in this SRD because public administrations are not in the target group of this document and because these aspects will be addressed in the upcoming EMAS SRD for public administrations[8].

7 See footnote 1 on page 2.

8 Information on the development of the EMAS SRD for the public administration sector is available at: http://susproc.jrc.ec.europa.eu/activities/emas/public_admin.html

3. BEST ENVIRONMENTAL MANAGEMENT PRACTICES, SECTOR ENVIRONMENTAL PERFORMANCE INDICATORS AND BENCHMARKS OF EXCELLENCE FOR THE BUILDING AND CONSTRUCTION SECTOR

3.1. Building design

This chapter is targeted at building designers (NACE code 71).

3.1.1. Integrated concepts for energy efficient building design

BEMP is to use integrated approaches achieving the best energy performance and best life cycle costs[9]. An integrated approach is one aimed at minimising the life cycle energy consumption looking at the building as a whole (i.e. joint design of at least the building envelope and the HVAC system). BEMP is to achieve a level of energy performance well above the minimum standards set in the national building codes[10] and to design nearly zero-energy buildings (NZEB) ahead of the EU obligation[11].

A relevant example of integrated concept for energy efficient building design is the Passive House concept. The aim of this approach is to provide an improved indoor environment (air quality and thermal comfort) with the minimum energy demand and cost. The basic idea of a Passive House is to improve the envelope to a point at which the heating and cooling demand becomes very low. The table below gives an overview of the requirements that define the Passive House concept and how they can be achieved.

Table 3.1: Example of requirements of an integrated concept for energy efficient building design: the Passive House requirements and measures to achieve them

Requirements	Measures to meet them
The building heating + cooling demand must be lower than **15 kWh/m^2/yr** The specific heat load should be less than **10 W/m^2** The building must not leak more air **than 0.6 times** the house volume at the 50 Pa test (n_{50} value) Total primary energy demand cannot be more than **120 kWh/m^2/yr**	Improved insulation. Recommended U-values less than **0.15 W/m^2/K** Design without **thermal bridges** Windows U-values lower than **0.85 W/m^2/K** Airtight. **Mechanical ventilation** with heat recovery from exhaust air **Innovative heating technology**

Applicability

9 It is best practice to consider not only life cycle costs but also all environmental aspects throughout the life cycle of the building. This includes, among others, sustainable and low embedded energy construction materials (see BEMP 3.2.1), design for easy re-use (e.g. flexible floor plans) and easy renovation, design for deconstruction and recycling (see BEMP 3.1.13).

10 Directive 2010/31/EU (Energy Performance of Buildings Directive, EPBD) requires Member States to set minimum energy performance standards for buildings, which need to be reflected in the national building codes. The Directive introduced a benchmarking system to gradually increase the level of ambition of these energy efficiency requirements, keeping them under regular review.

11 The EPBD requires that all new buildings consume very low or nearly zero energy ('nearly zero energy buildings') by 2020 or by 2018 if occupied and owned by public authorities.

Technically, integrated approaches are applicable everywhere, although their benefits may vary according to climate conditions. For instance, the Passive House approach was developed for houses in moderate climates but it is suitable and applicable in other warmer or colder zones, although with different results, as this approach seeks the optimal performance regarding the total life cycle costs.

The only limitation to the implementation of this BEMP by building designers can be the need of an higher initial investment and trust in the implementation of an integrated concept for energy efficiency building design from the client.

This BEMP is fully applicable to SME building designers, provided they can invest in the relevant training/capacity building.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i1) Specific final energy use per process[12] per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process[13] per unit of floor area and year (kWh/m^2/yr).	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b3) Renewable energy sources are used in an integrated design concept to cover the energy needs of the building.

3.1.2. Improving the energy performance of the building envelope

BEMP is to insulate the building and keep airtightness, to avoid thermal bridges, and to minimise the heat transfer, without a significant loss of useful area. Specific solutions for walls, roofs and glazing are presented in the next three BEMPs.

Applicability

This BEMP is applicable to all kinds of buildings including existing buildings undergoing renovation. The investment costs are usually high but cost savings are produced in the long term. With regard to the entire life cycle, insulation optimisation should consider the local climate.

This BEMP is fully applicable to building designers of all sizes.

Associated environmental performance indicators and benchmarks of excellence

12 This indicator should be calculated for the following main processes (if applicable/relevant): space heating, space cooling, domestic hot water, lighting, appliances/equipment.

13 See footnote above.

Environmental performance indicators	Benchmarks of excellence
(i1) Specific final energy use per process per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process per unit of floor area and year (kWh/m^2/yr).	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr.

3.1.3. Improving the energy performance of walls

BEMP is to use innovative insulation techniques for walls with improved environmental and economic performance.

Examples of these techniques are:

- transparent insulation reduces heat losses and increases solar gains in comparison with opaque insulation; with this system, the solar radiation passes the transparent insulation layer and is converted to heat at the dark coloured exterior surface of the inner shell of the wall;
- vacuum insulated panels have much lower thermal conductivity than conventional insulation materials (down to 0.004 W/mK); this facilitates the use of thinner insulation layers in comparison to conventional constructions; the evacuated (1 mbar) core material of the panel is covered by a high-performance aluminium foil.

Applicability

There are no restrictions on the applicability of this practice. Climatic zones can influence the implementation and the final characteristics of the wall, but not the suitability of the technique.

This BEMP is fully applicable to building designers of all sizes.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i1) Specific final energy use per process per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process per unit of floor area and year	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and

(kWh/m^2/yr).	cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr.

3.1.4. Improving the environmental performance of roofs

BEMP is to design and use cool brown and green roofs to improve the thermal behaviour of the building, with also a positive effect on biodiversity, water drainage performance and on the mitigation of the heat island effect.

A **cool roof** is a roofing system able to repel solar heat and keep roof surfaces cooler in the sun, in the same way as white houses often found in Mediterranean countries do. This ability to stay relatively cool in direct sunlight is due to the properties of the materials, which reflect the solar radiation (solar reflectance or albedo) and release the heat they have absorbed (infrared emissivity).

Brown and green roofs, also known as 'live roofs', are planted with vegetation. The overriding aim in designing such a roof is to encourage biodiversity, e.g. by compensating the loss of habitat or by providing protected habitats on the roof. Soil and rubble collected from the construction of a new building on a brownfield site can be used as brown roof substrate and provide a rooftop habitat for the flora and fauna of the former brownfield site. Green roofs act as an insulation layer: they stabilise temperatures during the summer and the winter and provide urban heat island mitigation benefits. Furthermore, storm water run-off is reduced by the absorption of water.

Applicability

There are no technical restrictions on the applicability of cool roofs but their benefits are limited to warmer climates. There is no limitation for the application of green or brown roofs, except for the water resistance factor and the suitable mechanical load (a green roof has a load of about 100 kg per m^2). Green roofs have economic benefits: they reduce the cost for the drainage system, increase the lifetime of the waterproof layer and can provide extra insulation to the building.

This BEMP is fully applicable to SME building designers.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i1) Specific final energy use per process per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process per unit of floor area and year (kWh/m^2/yr). (i3) Solar reflectance of the roof: material's ability to reflect sunlight on a scale from 0 to 1. (i4) Thermal emissivity of the roof: ability of the material's surface to emit energy by radiation.	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than

(i5) Biodiversity indicator: number of species living on the roof.	120 kWh/m^2/yr.

3.1.5. Best options for glazing

BEMP is to use the building configuration to allow best performing glazing, to maximise heat gains from solar radiation in winter and to use shading systems.

Applicability

Best performing glazing usually accompanies new, highly insulated buildings. Existing buildings can benefit from retrofitting of energy-efficient windows. High performing windows are applicable everywhere, but in warmer climates may need to be accompanied by efficient shading systems.

This BEMP is fully applicable to SME building designers.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i1) Specific final energy use per process per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process per unit of floor area and year (kWh/m^2/yr). (i6) Thermal emissivity of windows: ability of the material's surface to emit energy by radiation. (i7) U-value: energy performance for windows (W/m^2/K). (i8) g-value: heat gain from solar radiation (from 0 to 1).	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr.

3.1.6. Design and retrofitting of the Heating, Ventilation and Air Conditioning (HVAC) system

BEMP is to design or retrofit the HVAC system according to:

- its total integration in the building design (taking into account the envelope performance, an optimal solar gain, enhanced airtightness, expected internal gains, integration of natural and mechanical ventilation), oversizing avoidance, and optimised monitoring and control;

- the use of environmentally friendly heating and cooling systems (systems with proven performance in order to reduce the demand for primary energy and without cross-media effects over other environmental aspects), installing products with the top energy label classes (when applicable);

- the optimal maintenance cycles of the system.

Applicability

This BEMP is widely applicable. For existing HVAC systems, some retrofitting solutions with low investment costs are also available.

This BEMP is fully applicable to building designers of all sizes.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i1) Specific final energy use per process per unit of floor area and year (kWh/m^2/yr). (i2) Specific primary energy use per process per unit of floor area and year (kWh/m^2/yr). (i9) (for heat pumps) Heating seasonal performance factor (HSPF): total heating provided during the heating season divided by the total energy use during the same period. (i10) (for heat pumps) Coefficient of performance (COP): ratio of heat output to electricity or gas input for a specified source and output temperature. (i11) (for heat pumps in cooling mode) Energy efficiency ratio (EER): ratio between cold output and electricity or gas input for a specified source and output temperature.	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m^2/yr or a final specific heat load for heating or cooling lower than 10 W/m^2, and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m^2/yr and a total primary energy use (including all uses) lower than 120 kWh/m^2/yr.

3.1.7. Best performing lighting

BEMP is to reduce the energy demand for lighting through the application of:

- lighting strategies: limiting time of use, e.g. by installing occupancy sensors in low utilisation areas; only lighting to the illumination level required, e.g. by dimming unrequired lighting;

- daylighting: careful placing of windows, skylights, translucent wall panels or sunlight transport devices and reflective surfaces so that during the day natural light provides effective internal lighting;

- efficient lighting devices: optimising light output thanks to efficient lamps and luminaires, installing products with the top energy label classes (when applicable).

Applicability

Technically, there is no restriction on the use of best performing lighting strategies and devices, although there may be geographical restrictions for the integration of daylight. Lighting retrofitting usually has a fast payback period.

This BEMP is fully applicable to building designers of all sizes.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i12) Lighting Power Density (LPD): lighting power installed to meet illumination needs per unit of area (W/m^2). (i13) Lighting Energy Numeric Indicator (LENI): annual energy consumption for lighting per square metre ($kWh/m^2/yr$).	-

3.1.8. Use of renewable energy sources

BEMP is to use adequate renewable energy systems to meet the energy requirements of the building, once these have been minimised by implementing the relevant best practices to reduce the energy demand and increase the efficiency in the design or in the planned renovation of the building (see Sections 3.1.1 to 3.1.7). Additionally, BEMP is to ensure the responsiveness of the building to the energy demand in order to limit the need of relying on a carbon intensive grid.

Applicability

The potential to exploit particular renewable energy resources on site depends on the location- and site-specific factors such as climate, shading, available space, etc. These issues are not barriers to investment in off-site renewable energy installations. The economic performance is highly influenced by the different subsidy schemes available at national or local level.

This BEMP is fully applicable to SME building designers.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i14) Energy generation from renewable energy sources as a share of the total final energy need of the building, where 100 % means that the building is a net zero energy building on a yearly basis.	(b3) Renewable energy sources are used in an integrated design concept to cover the energy needs of the building.

3.1.9. Environmentally friendly water drainage systems

BEMP is to plan, design and optimise water drainage when designing a building in order to improve run-off water quality, increase infiltration and avoid flooding risks.

For this, the approach taken under the ‘Sustainable Drainage Systems’ (SUDS) philosophy is considered to be best practice as it follows state-of-the-art principles:

- it seeks the improvement of run-off water quality, reduces surface run-off, contributes to biodiversity and creates amenity value;
- it tries to replicate, as closely as possible, the natural drainage before development;
- the approach has an integrated management hierarchy of prevention, source control and site control.

Applicability

The specific techniques to be implemented in specific building designs need to be determined on a case-by-case basis, as they are strongly dependent on the climate and the precipitation regime of the affected region, and respecting the municipality's urban water management plan, where available.

This BEMP is fully applicable to SME building designers.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i15) Use of pre-treatment techniques (sedimentation, filtration, detention basin) and rainwater harvesting (y/n). (i16) Use of physico-chemical and biological treatments (y/n). (i17) Periodic maintenance plan of drainage system and chemical control monitoring of soil and groundwater (y/n).	-

3.1.10. Water-saving plumbing fixtures

BEMP is to plan, design and implement water-saving fixtures according to the best available techniques for saving water and fulfilling internationally recognised environmental criteria (such as the EU Ecolabels for sanitary tapware and for flushing toilets and urinals).

Applicability

Water-saving plumbing fixtures can be implemented either during the design stage of the building or in the context of renovation. Aerators, flow restrictors and low flow taps and showerheads are inexpensive and suitable where pressure is at least one bar, though they cannot be used with gravity systems. Systems based on pressure tanks may require larger installations and should be implemented during major renovations.

This BEMP is applicable to all building designers, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i18) Maximum flow for	(b4) The maximum available water flow rates for kitchen and basin taps without flow limiting device shall not exceed 6,0 l/min,

taps (litres/min).	with flow limiting device shall not exceed 8,0 l/min[14].
(i19) Maximum flow for showers (litres/min).	(b5) The maximum available water flow rates for showerheads and showers shall not exceed 8,0 l/min[15].
(i20) Water use for toilets (litres/flush).	(b6) For flushing toilets, the full flush volume shall not exceed 6 l/flush[16].

3.1.11. Non-potable water recycling systems

BEMP is to harvest rainwater, reuse it and recycle grey water.

Some water applications in buildings, such as toilet flushing and irrigation, do not require the use of potable water. The use of water recycled from on-site rainwater or grey water collection systems can considerably reduce demand for potable water from the mains supply:

- rainwater collection systems divert rainwater into storage tanks; run-off systems can be installed on roofs and other impervious surfaces; the water collected can be used for non-potable purposes such as toilet flushing, washing machines, irrigation, cooling towers or general cleaning purposes;

- grey water is the term used to describe waste water from activities such as bathing, showering, laundry, dishwashers, and excludes 'black water' from toilet flushing; grey water may be collected and reused for non-potable water applications such as toilet flushing and, in some cases, irrigation by the installation of separate waste water drainage systems for toilets and grey water sources.

Applicability

The installation of rainwater and grey water recycling systems is applicable to all new buildings. Retrofitting such systems to existing buildings is expensive and impractical unless the building is undergoing extensive renovation. Although always technically possible, the economic feasibility of rainwater collection is highly dependent on the climate.

This BEMP is applicable to all building designers, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i21) Percentage of available water from rainwater or from grey water treatment being reused in internal processes (%).	-

14 Kitchen and basin taps that are awarded the EU Ecolabel achieve this level of performance (see Commission Decision 2013/250/EU)

15 Showerheads and showers that are awarded the EU Ecolabel achieve this level of performance (see Commission Decision 2013/250/EU)

16 Toilets that are awarded the EU Ecolabel achieve this level of performance (see Commission Decision 2013/641/EU)

3.1.12. Preventing waste generation during construction by appropriate design

BEMP is to prevent the generation of waste during the construction phase through techniques for designing out waste.

These techniques include: reuse of the building structure, reuse of salvaged materials, use of modern methods of construction, introduction of flexibility and adaptability in design, use of prefabricated elements, reduction of the amount of off-cuts taking into account manufacturer dimensions, reduction of over ordering, etc.

Applicability

There is no restriction on the applicability of this practice for designers of new buildings. The market availability of some techniques and the traditional behaviour of the construction sector are the main limitations.

This BEMP is applicable to all building designers, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i22) Specific waste generation during the construction phase, measured as weight or volume per unit of area or other representative factor (kg/m^2).	-

3.1.13. Design for deconstruction

BEMP is to prevent waste generation during deconstruction through better design and selection of materials.

The most important decisions facilitating later deconstruction are made in the first stages of a building's life cycle, i.e. its design and construction stages. Key issues for deconstruction are an easy disassembly of construction elements, and the planning for possible reuses of construction elements or of the whole construction (adaptability). Deconstruction and reuse can be significantly facilitated by appropriate assembly (separable joints) techniques that prevent construction elements from being damaged as far as possible.

The main design principles are:

– design for flexibility and adaptability;

– design for prefabrication, preassembly and modular construction;

– design to accommodate deconstruction logistics;

– design to reuse materials;

– reduce building complexity;

– minimise building components and materials;

- simplify and standardise connectors;
- simplify and separate building systems;
- select fittings, fasteners, adhesives and sealants that allow for quicker disassembly and facilitate the removal of reusable materials;
- consider worker safety during deconstruction.

Applicability

The basic principles explained above can be applied to all new construction projects.

This BEMP is applicable to all building designers, including SMEs.

3.1.14. Green procurement for construction work

BEMP is for building designers to include environmental criteria in the technical specifications they prepare for tenders, public and private, for contracts for construction work. The criteria can encompass:

- the environmental capabilities of contractors;
- the energy performance of buildings (going beyond legislation);
- the heating and/or cooling systems;
- the renewable energy to be produced in new or renovated buildings (going beyond legislation);
- the fitness of the building for grids with a high share of renewable energy through a high demand-response capacity;
- the recycled content and the recyclability of construction materials;
- the environmental friendliness, resource efficiency and CO_2-storage capacity of construction materials and building elements;
- the exclusion of hazardous substances in construction materials;
- the ecodesign of the building structure;
- water-saving measures;
- indoor lighting;
- indoor air quality;
- the environmental performance of the construction site;
- the management of construction and demolition waste generated at the construction site;

- water drainage and groundwater management.

Applicability

This BEMP is fully applicable to building designers of all sizes which are requested by their clients to prepare technical specifications for tenders for construction work.

3.2. Construction products

This chapter is targeted at building designers (NACE code 71) and construction companies (NACE codes 41 and 43).

3.2.1. Selection of environmentally friendly construction products, building elements and materials

BEMP is to use environmental selection criteria for materials, products and construction elements. Criteria to be considered relate to the impact throughout their life cycle, such as the distribution and transportation distance, the performance during use (toxicity, release of pollutants, energy performance, noise protection and other indoor quality requirements), the CO_2-storage capacity[17] and the recyclability at the end of the building's lifetime.

The practices addressing the environmental performance of construction products should take into account indoor air quality requirements, especially those regarding the release of chemicals, e.g. VOCs, and their toxicity. In this respect, there are established environmental labels across Europe for wood, timber, paints, varnishes and floor coverings. Labels for other products are not widespread in all Member States.

In general, ensuring the lowest overall lifecycle impacts corresponds to selecting materials in the following order of priority:

- reuse of local construction products, building elements and materials (e.g. salvaged from the deconstruction of another building) – see Section 3.2.2;
- use materials with a high recycled content – see Section 3.2.3;
- use renewable materials from sustainable sources;
- include specifications for materials with a low environmental impact (e.g. products with an ISO Type I ecolabel[18], materials with high end-of-life recycling rate).

Applicability

This BEMP is applicable to all new construction and renovation projects, but the concrete choices will depend on a case-by-case basis on the local availability of the different options.

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17 Sustainably-sourced wood is an example of CO_2-storing construction material.

18 As part of the ISO 14000 series of environmental standards, the International Standards Organisation (ISO) has drawn up a subseries (ISO 14020) specific to environmental labelling, which covers three types of labelling schemes. In this context a "Type I" ecolabel is a multi-criteria label developed by a third party. Examples are, at EU level, the "EU Ecolabel" or, at national or multilateral level, the "Blaue Engel", the "Austrian Ecolabel" and the "Nordic Swan".

This BEMP is applicable to all building designers and construction companies, including SMEs. Nevertheless, SMEs may have less influence in driving the availability of the different options.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i23) Amount of construction products, building elements and materials reused: amount of reused materials in absolute units (t) or the percentage of natural materials substituted with reused materials (%). (i24) Amount of recycled material employed: amount of recycled materials in absolute units (t) or the percentage of natural materials substituted with recycled materials (%). (i25) Use of materials certified according to an ISO type I ecolabel (y/n). (i26) Percentage of wood with certificates of chain of custody (%).	(b7) More than one construction product category is 100 % compliant with an ISO type I ecolabel. (b8) 100 % of wood chain of custody is certified.

3.2.2. Reuse of construction products, building elements and materials

BEMP is to use materials salvaged from deconstruction of other buildings, such as metal frames, concrete structures, bricks or other ceramics, as well as from other construction sites. BEMP is to reuse auxiliary materials (e.g. pallets) as much as possible for construction sites.

Reuse practices can be performed for all materials and construction products used or collected on a site:

- Reuse of construction products and building elements. This is mainly applicable for materials harvested during deconstruction, which are reinserted in the materials cycle (e.g. bricks, tiles, concrete slabs, beams, wood frames). Some opportunities are also observed for construction sites, such as the use of remaining construction materials as auxiliary materials.
- Reuse of auxiliary materials. This reuse flow is more common in construction companies managing a number of sites. The reuse of wood structure from formworks, pallets, auxiliary structures, etc. has a significant impact on the economic performance of construction sites.

Applicability

This BEMP is applicable to all new construction and renovation projects. Nevertheless, in many instances the market for second-hand construction products is not well developed.

This BEMP is applicable to all organisations, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i23) Amount of reused construction products, building elements and materials employed: amount of reused materials in absolute units (t) or the percentage of natural materials substituted with reused materials (%).	-

3.2.3. Use of recycled materials

BEMP is to select and use recycled[19] materials, in particular those aggregates produced from construction waste.

Applicability

This BEMP is applicable to all new construction and renovation projects. The applicability of recycled aggregates depends on: heterogeneity, impurities, density, absorption, fines, and higher contents of chloride and sulphate. However, these are usually broadly applicable, as they fulfil the requirements. Also, there are voluntary agreements and regulations in place in some EU countries to ensure the environmental performance and avoid any pollution derived from the origin of the waste.

Generally, it is recommended to study the applicability of a recycled product case by case, especially when it comes to environmental and health-sensitive aspects.

This BEMP is applicable to all organisations, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i24) Amount of recycled material employed: amount of recycled materials in absolute units (t) or the percentage of natural materials substituted with recycled materials (%).	-

3.3. Construction and renovation

This chapter is targeted at construction companies (NACE codes 41 and 43).

[19] According to the Waste Framework Directive (2008/98/EC), "'recycling' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes" while "'preparing for re-use' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing". Therefore 'recycled construction products' refers to construction and demolition waste that was reprocessed into construction products, while 'reused construction products, building elements and materials' refers to reclaimed construction materials that can be employed again without reprocessing.

3.3.1. Improving environmental performance through better management: definition of environmental management plans and specific needs for environmental management systems

BEMP is to establish a specific environmental management plan (EMP) where all the measures to prevent and control pollution and to monitor the environmental performance are outlined. The EMP should include agreements between clients and contractors, an environmental risk assessment and allocation of resources for the environmental management of the site. Also, BEMP is to train and educate workers on the environmental management practices.

Applicability

There are no restrictions on the applicability of this BEMP. Some of its elements may even be considered mandatory in some countries, because required by regulation or since competition renders them almost a prerequisite in public tenders.

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i27) Workers are trained in the management of environmental aspects (y/n).	(b9) Environmental criteria are used in public-private and private-private agreements, and stated in an environmental management plan. (b10) All site foremen are trained on the environmental management system.

3.3.2. Monitoring the environmental performance of sites

BEMP is to estimate the environmental impact during the pre-construction phase, to monitor the environmental performance of the construction site during construction, and to establish mechanisms to check the improvement of the environmental performance of the construction site.

Applicability

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i28) Use of a comprehensive monitoring system for the construction site (y/n).	(b11) Environmental site management is checked comprehensively on a monthly basis according to a semi-quantitative method across all processes.

3.3.3. Waste prevention and management on the construction site

BEMP is to prevent and manage waste:

- to establish a site waste management plan, which includes specific actions for every type of waste, the expected amount of every type of waste, management options, allocation of resources, definition of responsibilities, etc. This waste management plan is established during the pre-construction phase and should take into account the building design (see Section 3.1.12) and be included in the communication to stakeholders;

- to separate and sort waste, diverting waste from landfill as much as possible;

- to maintain or establish a waste logistics system with optimised routing to reduce the carbon footprint of its transport.

Applicability

The amount of waste that can be effectively diverted from landfill or incineration without energy recovery depends on the availability of construction waste recovery infrastructure within a reasonable distance. The benefits from the recovery operations should be balanced with the carbon footprint of the necessary transport.

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i22) Specific waste generation during the construction phase, measured as weight or volume per unit of area or other representative factor (kg/m^2). (i29) Percentage of waste diverted from landfill or incineration without energy recovery (%).	(b12) Less than 5 % of material that can be reused or is recyclable is sent to landfill or incineration without energy recovery.

3.3.4. Increasing materials' use efficiency

BEMP is to establish material use efficiency procedures to reduce the amount of waste: just-in-time deliveries, consolidation centres, reverse logistics (where appropriate), management of remaining materials and integration into a logistics scheme, and best storage and handling practices.

Applicability

This BEMP is applicable to all construction companies, including SMEs. However, larger companies may have more weight to put in place more advanced measures, such as consolidation centres and reverse logistics.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i22) Specific waste generation during the construction phase, measured as weight or	(b12) Less than 5 % of material that can be reused or is recyclable is sent to landfill or incineration without energy

volume per unit of area or other representative factor (kg/m^2). (i29) Percentage of waste diverted from landfill or incineration without energy recovery (%).	recovery.

3.3.5. Water drainage management and erosion control on the construction site

BEMP is to protect soil from erosion and design a temporary drainage system with pollution control for exposed land; to minimise soil exposed to wind and rainwater; and to use sedimentation and filtering devices to avoid run-off water pollution. BEMP is to avoid substantial soil erosion by planning strategies, vegetative barriers, energy dissipators, dams, etc.

Applicability

Water drainage, sedimentation and soil erosion control measures are applicable to any construction site. Nevertheless, the specific measures to be implemented should be assessed and designed case by case. The main factors to be considered for the applicability of the measures should be the slope; the existence of channels, waterways and ditches; the existence of flat surface areas; and the management of borrow and stockpile areas for materials and topsoil storage.

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i30) Percentage of construction site area covered by impervious pavement (%). (i31) Percentage of soil loss (%), to monitor soil erosion. (i32) Total suspended solids (TSS), to monitor sedimentation. (i33) Number of best practices applied to control water drainage, soil exposure and sedimentation. (i34) Water monitoring system implemented (y/n). (i35) Procedure for cleaning surroundings of dirtiness is implemented (y/n). (i36) Vegetation barriers are used to control water infiltration (y/n).	(b13) Water use and drainage from/to natural waterways is monitored at the construction site.

3.3.6. Dust prevention and control

BEMP is to reduce dust by establishing a dust management plan, where dust is expected to be a sensitive issue for the construction/deconstruction site, limiting site clearance which leaves bare soil exposed, spraying water and applying physical and chemical barriers and other control measures for dust generation. BEMP is to monitor the effects of dust prevention plans.

Applicability

This BEMP is applicable to all construction and deconstruction sites, although there are important differences between large construction sites, with huge areas of soil exposed, and small, urban sites. Dust also has to be considered a very important health issue, especially for those people working in closed environments.

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i37) Use of dust suppression techniques (y/n).	(b14) Dust prevention efficiency is higher than 90 %.

3.3.7. Disturbance management

BEMP is to reduce disturbances to the neighbourhood, especially in sensitive areas, such as residential areas or sites close to natural spaces; to reduce noise and vibration by establishing appropriate prevention and mitigation measures; to reduce night lighting by rescheduling works when appropriate, installing screens and directional lighting; to prevent odours and air emissions avoiding fires, stopping machinery not in use and keeping good practices for chemicals and fuels; and to establish procedures for complaint management.

Applicability

This BEMP is applicable to all construction sites, although it is more relevant for sites in urban areas.

This BEMP is applicable to all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i38) Equivalent sound level (Leq) produced in the construction site. (i39) Number of complaints from the neighbourhood due to noise, night lighting, odours and other air emissions.	-

3.3.8. Improving energy efficiency and reducing pollution from engines

BEMP is to select machinery with a high level of energy efficiency and with low associated emissions, especially regarding NO_x and particulate materials. Moreover, BEMP is to select cabins[20] with high energy efficiency (insulation, glazing, lighting, sensors) or retrofit these features in existing cabins to achieve the best possible energy efficiency.

Applicability

There is no technical restriction on the applicability of this BEMP.

This BEMP can be implemented by all construction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i40) Construction-site energy use: Energy use of the construction site per m^2 of construction site or building (kWh/m^2) or per km of linear work (kWh/km). (i41) Process-oriented indicators, e.g. volume of fuel per m^3 of transported material, energy use per m^3 of excavated material. (i42) Particle emissions from engines in use (g/kWh).	-

3.4. Building operation and maintenance

This chapter is targeted at building management companies and companies providing services for buildings (NACE codes 68 and 81).

3.4.1. Building management systems

BEMP is to install building management systems (BMS) to ensure the appropriate monitoring and use of building facilities. BMS, also called 'building automation systems' (BAS) are central computerised systems for managing and operating various equipment and sensors within a building by registering all information and, in some cases, reacting to it. They aim to optimise the operational phase of a building, through the monitoring and control of building mechanical and electrical systems. Energy optimisation is one of the main functions of a BMS, with the objective to achieve an optimal level of control of occupant comfort while minimising energy and resource consumption.

Applicability

BMS can be used in office and institutional buildings as well as in large residential buildings. Home automation systems can be installed in individual residential dwellings. BMS are mostly integrated during the design process, but it is also possible to integrate them into existing buildings, even though this requires the installation of an additional infrastructure for

[20] Construction site cabins are temporary construction facilities that provide indoor space to site managers and site workers during the project for offices, meetings, trainings, canteen, changing room or common areas. Cabins are used on most construction sites.

data collection (sensor systems), which is more expensive, and the optimisation of the energy systems that can be achieved may be more limited. In large office buildings, integrated BMS solutions are usually designed within the framework of total facilities management.

This BEMP is applicable to all building management companies, including SMEs. However, SMEs may be limited in the extent to which they can apply and benefit from BMS, as it requires an important investment.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i1) Specific final energy use per process per unit of floor area and year ($kWh/m^2/yr$). (i2) Specific primary energy use per process per unit of floor area and year ($kWh/m^2/yr$).	-

3.4.2. Water monitoring, maintenance and management optimisation

BEMP is to monitor water consumption, detect leakages and properly maintain the water system in the building.

Monitoring and benchmarking of water consumption is the first step to improve water use efficiency. Monitoring of water use can be performed at varying levels of detail depending on the resources available and the size of the premises. A good maintenance plan should comprise a water audit and benchmarking, periodic monitoring (daily, weekly, monthly), sub-metering, continuous monitoring, system inspection and maintenance, excessive pressure avoidance, conditioning of water and adequate insulation for cold or hot water.

Applicability

Monitoring and maintenance are applicable as a best practice for all types and sizes of buildings. In small buildings, periodic monitoring may simply involve recording total water consumption (at least) monthly based on meter readings.

This BEMP is applicable to all building management companies and companies providing services for buildings, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i43) Percentage of building zones or units or relevant processes for water consumption with separate water monitoring (%). (i44) Water consumption of the building per day per occupant or surface area (litres/person/day; $litres/m^2/day$).	(b15) All relevant water-consuming processes are monitored in all building units. (b16) Water consumption is lower than a relevant benchmark in the specific sector of the building user, e.g. those benchmarks of excellence proposed in other SRDs.

3.4.3. Environmentally friendly cleaning practices

BEMP is to use environmentally friendly cleaning agents and services, such as self-cleaning coating, the use of cleaning agents containing no harmful substances and the optimisation of cleaning management.

Applicability

There are no limitations regarding green cleaning services, but in hygiene-sensitive areas (e.g. hospitals, areas of food preparation) additional cleaning, e.g. with antibacterial or antiviral cleaning products and techniques, may be necessary.

This BEMP is applicable to all building management companies and companies providing services for buildings, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i44) Water consumption of the building per day per occupant or surface area (litres/person/day; litres/m^2/day). (i45) Use of products certified according to an ISO type I ecolabel as cleaning agents (y/n).	(b15) All relevant water-consuming processes are monitored in all building units. (b16) Water consumption is lower than a relevant benchmark in the specific sector of the building user, e.g. those benchmarks of excellence proposed in other SRDs. (b17) At least one category of cleaning products used is 100 % compliant with an ISO type 1 ecolabel (e.g. EU Ecolabel).

3.5. Building end-of-life

This chapter is targeted at construction and deconstruction companies (NACE codes 41 and 43).

3.5.1. Apply the waste hierarchy to end-of-life buildings

BEMP is to apply the waste hierarchy in the decision-making process concerning end-of-life buildings. With regard to the building as a whole, the priority is for the reuse of the end-of-life building, followed by the reclamation for reuse of materials, products and construction elements and finally the sorting of deconstruction and demolition waste streams for recycling.

Applicability

This BEMP is addressed to all construction and deconstruction companies, including SMEs.

3.5.2. Selection of environmentally friendly deconstruction/demolition techniques

BEMP is to use environmentally friendly deconstruction and demolition techniques, e.g. deconstructing and demolishing buildings selectively, maximising the amount of salvaged materials and the recyclability of the waste generated.

Applicability

There are no considerable technical limitations to the applicability of this BEMP, although the extent to which selective deconstruction is possible depends on the previous building design.

Factors affecting the deconstruction process which may limit material recovery are:

- safety, which may increase project costs;
- time: deconstruction projects need more time than conventional demolition, so higher costs are expected;
- quality and market acceptance: the cost of removing an element (e.g. a roof tile) should be compensated for by its price, while, at the same time, the reused element should be competitive and accepted by future users;
- space: when there is a space limitation on a site, good planning is required; at the same time, some potential recycling processes may not be possible due to excessive time or higher costs (e.g. through intermediate storage);
- location: the potential recovery of materials from a deconstruction project is subject to the availability of nearby recovery/recycling facilities;
- weather: some techniques may require certain weather conditions that may not be coincident with project timing;
- price fluctuations: for instance, scrap and other construction material recyclability depends in part on fluctuating market prices.

This BEMP is applicable to all construction and deconstruction companies, including SMEs, with a specialised profile in deconstruction and demolition projects.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i46) Specific waste generation during the deconstruction phase, measured as weight or volume per unit of area or other representative factor (kg/m^2). (i29) Percentage of waste diverted from landfill or incineration without energy recovery (%).	(b12) Less than 5 % of material that can be reused or is recyclable is sent to landfill or incineration without energy recovery

3.5.3. Construction and demolition/deconstruction waste sorting and processing

BEMP is to maximise the amount and applicability of materials from waste sorting and processing.

Deconstruction and/or demolition waste should be separated during the deconstruction activity, as mono-fractional waste streams are preferable for recycling. Subsequent separation and improvement of the quality of recycled materials by processing and sorting is technically limited. Nevertheless, it is still important to use these technologies as, in some cases, the separate collection of wastes is not an option at the deconstruction site, e.g. due to available space.

Applicability

This BEMP is addressed to construction and deconstruction companies. Generally, it is applicable to all construction wastes though the quality requirements determine the degree of separation needed. Market aspects, such as recycled material acceptability, can influence the final economic performance. Aggregates and other recycled products may have low acceptance levels in some EU regions.

This BEMP is applicable to all construction and deconstruction companies, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i29) Percentage of waste diverted from landfill or incineration without energy recovery (%).	(b12) Less than 5 % of material that can be reused or is recyclable is sent to landfill or incineration without energy recovery

4. RECOMMENDED SECTOR-SPECIFIC KEY ENVIRONMENTAL PERFORMANCE INDICATORS

The following table lists **a selection** of key environmental performance indicators for the building and construction sector. These are a subset of all the indicators mentioned in Chapter 3. The table is divided by target group into four parts: key indicators for building designers; key indicators for construction and deconstruction companies; key indicators for both building designers and construction and deconstruction companies related to the choice of construction products/materials; and key indicators for building management companies and companies providing services to buildings**.**

Due to the nature of the sector, best practice and indicators are formulated from a building / construction project perspective. For EMAS registered organisations, the indicators below should therefore be taken into account at the level of a project / site / building or a selection of these within the portfolio of the organisation (indicating which fraction of their annual work those projects represent). The organisation is invited to state whether the level of performance achieved by the selected project(s) is typical for the organisation or if this is an example of best performance achieved by the organisation.

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
BUILDING DESIGNERS (NACE CODE 71)							
1. Specific energy use of the building	kWh/m^2/yr	– building designers (architects, engineers)	Energy use per unit of floor area and year expressed in terms of either final or primary energy. Indications: Generation of renewable energy should not be subtracted from the energy use figures.	Per site or equivalent and at the organisational level (aggregated value) Per main energy-consuming process: space heating, water heating, lighting, other uses of electricity and specific processes (where applicable) and total primary energy consumption per energy source	Energy efficiency	(b1) For new builds, the building is designed with an energy need for heating and cooling lower than 15 kWh/m2/yr or a final specific heat load for heating or cooling lower than 10 W/m2, and a total primary energy use (including all uses) lower than 120 kWh/m2/yr. (b2) For existing buildings undergoing renovation, the building is designed with an energy need for heating and cooling lower than 25 kWh/m2/yr and a total primary energy use (including all uses) lower than 120 kWh/m2/yr.	BEMPs 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
2. Generation from renewable energy sources as a share of the total final energy need of the building	%	– building designers (architects, engineers)	Generation from renewable energy sources as a share of the total final energy need of the building, where 100% means that the building is a net zero energy building on a yearly basis.	Per site Per source of energy	Energy efficiency	(b3) Renewable energy sources are used in an integrated design concept to cover the energy needs of the building	BEMPs 3.1.1, 3.1.8
3. Lighting Power Density	W/m^2	– building designers (architects, engineers)	Lighting power installed to meet illumination needs per unit of area Indications Lumens per m^2 is a good technical indicator, but the environmental performance should be measured in terms of W/m^2. It can vary within the site (per zone) and during the day (per period).	Per site or equivalent Per zone and per day or period, where appropriate (linked to lighting plans)	Energy efficiency	-	BEMP 3.1.7

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
4. Water flows in plumbing fixtures	litres/min litres/flush	– building designers (architects, engineers)	Maximum flow for taps (litres/min) Maximum flow for showers (litres/min) Water use for toilets (litres/flush)	Per site	Water	(b4) The maximum available water flow rates for kitchen and basin taps without flow limiting device shall not exceed 6,0 l/min, with flow limiting device shall not exceed 8,0 l/min. (b5) The maximum available water flow rates for showerheads and showers shall not exceed 8,0 l/min. (b6) For flushing toilets, the full flush volume shall not exceed 6 l/flush.	BEMP 3.1.10

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
5. Water recycling	%	– building designers (architects, engineers)	Percentage of available water from rainwater or from grey water treatment being reused in internal processes	Per site	Water	-	BEMP 3.1.11
CONSTRUCTION PRODUCTS (NACE CODES 41, 43, 71)							
6. Amount of reused construction products, building elements and materials employed	t %	– building designers (architects, engineers); – constructio n companies	Amount of reuse materials in absolute units (t) or percentage of natural materials substituted with reused materials	Per material category	Materials	-	BEMPs 3.2.1, 3.2.2

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
6. Amount of recycled materials employed	t %	– building designers (architects, engineers); – constructio n companies	Amount of recycled materials in absolute units (t) or percentage of natural materials substituted with recycled materials	Per material category	Materials	-	BEMPs 3.2.1, 3.2.3
7. Use of materials certified according to an ISO type I ecolabel	y/n	– building designers (architects, engineers); – constructio n companies	Use of materials that were awarded an ISO type I ecolabel (third party verified)	Per material category	Materials	(b7) More than one construction product category is 100 % compliant with an ISO type I ecolabel.	BEMP 3.2.1

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	**Related core indicator** in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
8. Percentage of wood with certificates of chain of custody	%	– building designers (architects, engineers); – construction companies	Percentage of wood bearing a certificate of chain of custody	Per site Per wood element	Materials	(b8) 100 % of wood chain of custody is certified.	BEMP 3.2.1
BUILDING CONSTRUCTION AND DECONSTRUCTION COMPANIES (NACE CODES 41, 43)							
9. Specific waste generation	kg/m^2	– construction companies	Amount of waste generated during the construction or deconstruction phase per square metre or other representative factor	Per waste type Per site	Waste	(b12) Less than 5 % of material that can be reused or is recyclable is sent to landfill or incineration without energy recovery.	BEMPs 3.3.3, 3.3.4, 3.5.2, 3.5.3
10. Use of dust suppression techniques	y/n	– construction companies	Avoidance of dust generation.	Per site	Emissions	(b14) Dust prevention efficiency is higher than 90 %.	BEMP 3.3.6

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
11. Water monitoring system implemented	y/n	– construction companies	A water monitoring system is in place at the construction site to control water drainage and erosion.	Per site	Water	(b13) Water use and drainage from/to natural waterways is monitored at the construction site.	BEMP 3.3.5
12. Use of a comprehensive monitoring system for the construction site	y/n	– construction companies	A comprehensive list of criteria is used to control the environmental performance of the construction site.	Per site	All	(b11) Environmental site management is checked comprehensively on a monthly basis according to a semi-quantitative method across all processes.	BEMP 3.3.2
13. Workers are trained in environmental management aspects	y/n	– construction companies	Site workers are trained on the environmental management practices of the company.	Per site	All	(b9) Environmental criteria are used in public-private and private-private agreements, and stated in an environmental management plan. (b10) All site foremen are trained on the environmental management system.	BEMP 3.3.1

Indicator	**Common unit**	**Main target group**	**Short description**	**Recommended minimum level of monitoring**	**Related core indicator** in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	**Benchmark of excellence**	**Related best environmental management practice**
BUILDING MANAGEMENT COMPANIES AND SERVICE PROVIDERS (NACE CODES 68, 81)							

Indicator	**Common unit**	**Main target group**	**Short description**	**Recommended minimum level of monitoring**	**Related core indicator** in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	**Benchmark of excellence**	**Related best environmental management practice**
14. Specific energy use of the building	kWh/m^2/yr	– building management companies and service providers	Energy use per unit of floor area and year expressed in terms of either final or primary energy. Indications: Generation of renewable energy should not be subtracted from the energy use figures.	Per site or equivalent and at the organisational level (aggregated value) Per main energy-consuming process: space heating, water heating, lighting, other uses of electricity and specific processes (where applicable) and total primary energy consumption per energy source	Energy efficiency	-	BEMP 3.4.1

Indicator	Common unit	Main target group	Short description	Recommended minimum level of monitoring	Related core indicator in accordance with Annex IV to Regulation (EC) No 1221/2009 (Section C.2)	Benchmark of excellence	Related best environmental management practice
15. Water monitoring	%	– building manageme nt companies and service providers	Percentage of building zones or units with separate water monitoring. Alternatively, percentage of relevant process for water consumption with separate water monitoring.	Per zone (e.g. per office or per floor of the building)	Water	(b15) All the relevant water-consuming processes are monitored in all building units.	BEMP 3.4.2
16. Water consumption	litres/pers/ day litres/m^2/ day	– building manageme nt companies and service providers	Water consumption of the building per day per occupant or surface area	Per process Per zone (e.g. per office area or per floor)	Water	(b15) All relevant water-consuming processes are monitored in all building units. (b16) Water consumption is lower than a relevant benchmark in the specific sector of the building user, e.g. those benchmarks of excellence proposed in other SRDs.	BEMPs 3.4.2, 3.4.3
17. Use of products certified according to an ISO type I ecolabel as cleaning agents	y/n	– building manageme nt companies and service providers	Use of cleaning products that were awarded an ISO type I ecolabel (third party verified).	Per category of cleaning products	Materials	(b17) At least one category of cleaning products used is 100 % compliant with an ISO type 1 ecolabel (e.g. EU Ecolabel).	BEMP 3.4.3