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ANNEX

ANNEX

to the

Commission Decision

on the sectoral reference document on best environmental management practices, environmental performance indicators and benchmarks of excellence for the fabricated metal products manufacturing sector for the purposes of Regulation (EC) No 1221/2009 of the European Parliament and of the Council

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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 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 fabricated metal products manufacturing 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.

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.

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1 The scientific and policy report is publicly available on the JRC website at the following address: https://susproc.jrc.ec.europa.eu/activities/emas/fab_metal_prod.html. 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 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 fabricated metal products manufacturing sector to focus on relevant environmental aspects, both direct and indirect, and to find information on best environmental management practices, as well as appropriate sector-specific environmental performance indicators to measure their environmental performance, and benchmarks of excellence.

How SRDs should be taken into account by EMAS-registered organisations:

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) When reporting on environmental performance and on other factors regarding environmental performance, 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

[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 other relevant existing environmental performance indicators 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.*"

used to identify measures and actions, and possibly to set priorities, to (further) improve their environmental performance. However, implementing best environmental 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 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. When specific

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/BEMP_FabMetProd_BackgroundReport.pdf .

environmental performance indicators and benchmarks of excellence could be formulated for a particular BEMP, these are also given. However, defining benchmarks of excellence was not possible for all BEMPs, either because of the limited availability of data or because of the specific conditions of each company and/or plant (type of products manufactured ranging from small prototypes and products with complex geometries, manufactured in small series or large series, to large or small components, diversity of manufacturing processes carried out in each manufacturing facility, etc.) vary to such an extent that a benchmark of excellence would not be meaningful. Even when benchmarks of excellence are given, these are not meant as targets for all companies to reach or metrics to compare the environmental performance across companies of the sector, but rather as a measure of what is possible to help individual companies assess the progress they made and motivate them to improve further. Finally, Chapter 4 presents a comprehensive table with a selection of the most relevant environmental performance indicators, associated explanations and related benchmarks of excellence.

Organisations are invited to consult it if interested in learning more about some of the best practices described in this SRD.

2. SCOPE

This reference document addresses the environmental performance of the fabricated metal products manufacturing sector. The target group of this document are companies belonging to the fabricated metal products manufacturing sector, and specifically companies to the following NACE codes (according to the statistical classification of economic activities in the European Community established by Regulation (EC) No 1893/2006[6]):

NACE Division 24* "Manufacture of basic metals"

- 24.2 Manufacture of tubes, pipes, hollow profiles and related fittings, of steel (24.20)
- 24.3 Manufacture of other products of first processing of steel (24.31 - 24.34)
- 24.5 Casting of metals (24.51 – 24.54)

NACE Division 25 "Manufacture of fabricated metal products, except machinery and equipment" (included all activities)

NACE Division 28** "Manufacture of machinery and equipment n.e.c."

- 28.1 Manufacture of general – purpose machinery (including only 28.14 and 28.15)

NACE Division 29** "Manufacture of motor vehicles, trailers and semi-trailers"

- 29.3 Manufacture of other parts and accessories for motor vehicles (29.32)

NACE Division 32** "Other manufacturing"

- 32.1 Manufacture of jewellery, bijouterie and related articles (32.11-32.13)
- 32.2 Manufacture of musical instruments (32.20)
- 32.3 Manufacture of sports goods (32.30)
- 32.4 Manufacture of games and toys (32.40)
- 32.5 Manufacture of medical and dental instruments and supplies (32.50)

NACE Division 33 "Repair and installation of machinery and equipment"

- 33.2 Repair of fabricated metal products, machinery and equipment (33.11 - 33.12**)

This reference document is divided into three main sections (Table 2-1) which cover, from the perspective of the manufacturers, the main environmental aspects of the fabricated metal products manufacturing companies.

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[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). NB: NACE stands for *Nomenclature statistique des Activités économiques dans la Communauté Européenne*.

* Only small scale operations (considerably smaller than IED thresholds with substantially different manufacturing processes, e.g. much more manual than automated processes).

** These activities are considered in scope insofar as the products concerned are composed mainly of metal.

Table 2-1: Structure of the reference document for the fabricated metal products manufacturing sector and main environmental aspects addressed

Section		Description	Main environmental aspects addressed
3.1	BEMPs for the cross-cutting issues	This section encloses practices that provide guidance on how manufacturers can integrate environmental sustainability frameworks into their existing business models and management systems in order to reduce their environmental impacts.	Site management
3.2	BEMPs for the optimisation of utilities	This set of BEMPs provides guidance on how to improve the overall environmental performance of the supporting processes of the manufacturing plants, such as lighting or ventilation etc.	Utilities and maintenance
3.3	BEMPs for the manufacturing processes	This section encloses practices that improve the environmental performance of the core manufacturing operations.	Industrial processes

The direct and indirect environmental aspects presented in Table 2-2 and Table 2-3 respectively, were selected as the most commonly relevant in the sector. However, the environmental aspects to be managed by specific companies need to be assessed on a case-by-case basis.

Table 2-2: Most relevant direct environmental aspects and related main environmental pressures addressed in this document

Processes	Most relevant direct environmental aspects	Related main environmental pressures
Supporting processes	Management, procurement, supply chain management, quality control	Raw materials Energy Water Consumables Waste: non-hazardous
	Logistics handling, storage, packaging	Raw materials Energy GHG emissions Water Consumables Emissions to air Noise, odour, vibration etc. Land use Biodiversity Waste: non hazardous
	Emission treatment	Energy Consumables Emissions to water Emissions to air Noise, Odour, vibration etc. Waste: non-hazardous, hazardous

Processes	Most relevant direct environmental aspects	Related main environmental pressures
	Utilities and maintenance	Energy Water Consumables Emissions to water Noise, odour, vibration etc. Waste: non hazardous, hazardous Land use Biodiversity
Manufacturing processes	Casting	Raw materials Energy Waste: hazardous
	Shaping	Raw materials Energy Noise, odour, vibration etc. Waste: hazardous
	Metal powder	Raw materials Energy Noise, odour, vibration etc. Waste: hazardous
	Heat treatment	Raw materials Energy Noise, odour, vibration etc. Waste: hazardous GHG gases (including F-gases, e.g. from cooling)
	Removing	Raw materials Energy Water Consumables Emissions to water Emissions to air Noise, odour, vibration etc. Waste: non-hazardous
	Additive processes	Raw materials Energy Noise, odour, vibration etc. Waste: hazardous, non hazardous
	Deformation	Raw materials Energy Noise, odour, vibration etc. Waste: hazardous
	Joining	Raw materials Energy Consumables Emissions to air Noise, odour, vibration etc. Waste: non-hazardous

Processes	Most relevant direct environmental aspects	Related main environmental pressures
	Surface treatment	Raw materials Energy Water Consumables Emissions to water Emissions to air Noise, odour, vibration etc. Waste: non-hazardous, hazardous
	Assembly	Energy Consumables Noise, odour, vibration etc. Waste: hazardous
Product and infrastructure design	Product design	Raw materials Energy Water Consumables Emissions to air
	Infrastructure design (plant level)	Raw materials Energy Water Consumables Emissions to air Emissions to water Waste: non-hazardous Land use Biodiversity
	Process design (plant level)	Raw materials Energy Water Consumables Emissions to air Emissions to water Waste: hazardous, non-hazardous

Table 2-3. Most relevant indirect environmental aspects and related environmental pressures

Activities	Most relevant indirect environmental aspects	Related main environmental pressures
Upstream activities	Raw material extraction and metal production	Raw materials Energy & related GHG emissions Water Consumables Emissions to water Emissions to air
	Tools and equipment production	
wnstream activitie	Use and service phase	Raw materials

Activities	Most relevant indirect environmental aspects	Related main environmental pressures
	End of Life	Energy & related GHG emissions Consumables Emissions to air Waste: hazardous, non-hazardous
	Waste management	

The environmental aspects of the NACE codes under the scope of this report that are covered by the Reference Documents on Best Available Techniques (BREFs)[7], directly or indirectly linked to the manufacture of fabricated metal products manufacturing as well as by EU legislation, policy instruments and best practice guidance are excluded from the scope of this document.

3. BEST ENVIRONMENTAL MANAGEMENT PRACTICES, SECTOR ENVIRONMENTAL PERFORMANCE INDICATORS AND BENCHMARKS OF EXCELLENCE FOR THE FABRICATED METAL PRODUCTS MANUFACTURING SECTOR

3.1. BEMPs for cross cutting issues

This section is relevant for the fabricated metal products manufacturers.

3.1.1. Applying effective methods for environmental management

BEMP is to use effective methods for environmental management, in order to optimise process and product design at the production stage and reduce environmental impacts along the whole value chain. This framework encompasses two levels:

The strategic, with the envisioning such as circular economy and life cycle thinking approaches,

The operational, with the use of tools that ensure continuous improvement of the environmental performance such as lean management and stock reduction.

Applicability

The BEMP is broadly applicable for all companies, including SMEs. Lack of sufficient in-house technical knowledge and the need for staff training can limit the applicability of this BEMP.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i1) Resource efficiency (kg finished products / kg of material input (alternatively: kg waste produced/kg input materials in case the kg finished products are not known) (i2) Mapping of material flows and their	(b1) Systematic consideration of life cycle thinking, lean management and circular economy in all strategic decisions making. (b2) New products development are

[7] Information on the Reference Documents on Best Available Techniques is available at: https://eippcb.jrc.ec.europa.eu/index.html

Environmental performance indicators	Benchmarks of excellence
environmental relevance (Y/N) (i3) On-site energy use (kWh / kg finished product or manufactured part[8]) (i4) Scope 1, 2 and 3 greenhouse gas-emissions (kg CO_2 equivalent / kg finished product or manufactured part) (i5) Water use (l water / kg finished product or manufactured part)	assessed for environmental improvements

3.1.2. Collaboration and communication along and across the value chain

BEMP is to collaborate with other companies within the sector, companies in other sectors and throughout the value chain. This collaboration can be organised as:

Sustainable sourcing and procuring of materials and other auxiliary inputs required and use of renewable energy for manufacturing operations;

Optimising resources by sharing energy and/or resources in an industrial symbiosis network;

Engaging systematically with stakeholders on the development of new environmentally friendly products and on the improvement of the environmental performance of the existing ones.

Applicability

This BEMP is broadly applicable to all size of companies in the sector, including SMEs.

Lack of sufficient in-house technical knowledge and the need for staff training implies extra costs that may constitute a significant barrier for some companies, especially for SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i6) Percentage of goods and services (% of the total value) which are environmentally certified or with a demonstrably reduced environmental impact. (i7) Use of by-products[9], residual energy or other resources from other companies (kg materials from other companies / kg total input; MJ energy recovered from other companies / MJ total energy use). (i8) Systematic stakeholder involvement with a focus on improved environmental performance (e.g. in product design, improved supply chain environmental performance, sustainable sourcing, cooperation for improved waste management) (Y/N) (i9) Purchase of second-hand machines or use of	(b3) All purchased goods and services meet environmental criteria established by the company. (b4) Collaboration with other organisations to use energy and resources more efficiently at systemic level (b5) Structural engagement of stakeholders in the

[8] The output (expressed in the indicators as kg finished product or manufactured part) can be expressed in different ways: number of parts, kg of products etc. depending on the type of products and their homogeneity/heterogeneity. Companies can choose suitable metrics to express the output.

[9] Companies that utilise waste materials for energy i.e. heat production by other companies, must have in place appropriate and effective emission treatments systems to avoid air pollution

machinery from other companies (Y/N) (i10) Amount of packaging waste (kg of packaging waste / kg finished product or manufactured part)	development of more environmentally friendly products.

3.1.3. Energy management

BEMP is to optimise energy use by implementing an energy management plan including systematic and detailed energy monitoring across manufacturing sites at the process level, comprising the following elements:

Establishing an energy strategy and detailed action plan;

Gaining commitment from senior management;

Defining ambitious and achievable targets and achieve continuous improvement;

Performance measurement and assessment at the process level;

Communication of energy issues across the organisation;

Staff training and encouragement for active engagement;

Investment in energy efficient equipment and consideration of energy efficiency in procurement processes.

The plan can be based on a standardised or customised format, such as ISO 50001 or as part of a global environmental management system like EMAS.

Applicability

The BEMP is applicable to all types of companies in this sector, including SMEs.

The lack of in-house technical knowledge, especially in smaller companies can be a limitation for the applicability of this BEMP. Additionally, improper integration of the elements of the energy management system and weak communication across the organisation can downgrade the performance and effectiveness of the energy management system in place.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i11) Energy use per manufactured product (kWh / kg finished product or manufactured part). (i12) Energy monitoring system at process level (Y/N)	(b6) Continuous energy monitoring at process level is implemented and driving energy efficiency improvements

3.1.4. Environmentally sound and resource efficient management of chemicals

BEMP is to optimise the amounts of chemicals used for manufacturing processes, minimise the chemicals that are disposed of and substitute hazardous chemicals wherever possible with more environmentally friendly alternatives.

To achieve these aims, fabricated metal products manufacturers can implement the following measures:

reviewing the current chemical use and management on-site;
monitoring the chemical use at the level of individual chemicals (and not several chemicals together) and focusing on the most important chemicals used;
reducing the chemical use wherever possible, e.g. by changing manufacturing processes, using the chemicals more efficiently, adopt business models that align incentives between chemical suppliers and users to incentivise the reduction of chemical volumes;
replacing hazardous chemicals and substituting with alternatives with lower environmental impact;
reducing chemical waste and outflows, e.g. by reusing or recycling chemicals;
where relevant, using external expertise, such as through partial or total outsourcing of chemical management.

Applicability

The BEMP is broadly applicable by all type of companies of the sector, including SMEs.

The operation of the described chemical management system requires some technical knowledge, which may be an important barrier, especially for the SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i13) For individual chemicals used, amount of chemical applied (kg / kg finished product or manufactured part) and its classification according to Regulation 1272/2008 (CLP Regulation) (i14) Amount of (hazardous) chemical waste generated (kg / kg finished product or manufactured part)	(b7) Regular (at least once a year) review the use of chemicals to minimise their use and explore opportunities for substitution

3.1.5. Biodiversity management

BEMP is to take into account direct and indirect impacts throughout the value chain and on-site manufacturing processes, by taking the following actions:

Assessing direct impacts by conducting a site review and identifying hotspots;
Conducting an ecosystem management review to identify the impacts of ecosystem services throughout the value chain;
Working with relevant (local) stakeholders to minimise any issues;
Measuring impacts by defining and monitoring relevant metrics;
Regular reporting to share information about the company's efforts.

Applicability

The BEMP is broadly applicable to all types of companies in this sector, including SMEs.

The implementation of the elements of the BEMP requires commitment from the hierarchy. The direct benefits from the implementation of the elements of this BEMP

are not possible to be quantified. Similarly, the calculation of a direct return of investment when applying the elements of the BEMP is not possible as well. These two points can constitute a significant barrier especially for the SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i15) Number of projects collaborations with stakeholders to address biodiversity issues (no) (i16) If located in or adjacent to protected areas: size of areas under biodiversity friendly management in comparison to total area of company sites (%) (i17) Inventory of land or other areas, owned, leased or managed by the company in or adjacent to protected areas or areas of high biodiversity value (area, m^2) (i18) Procedure/instruments in place to analyse biodiversity related feedback from customers, stakeholders, suppliers (Y/N) (i19) Implementation of a site biodiversity action plan in all manufacturing facilities (Y/N) (i20) Total size of restored habitats and/or areas (on-site or both on-site and off-site) to compensate for damages to biodiversity caused by the company (m^2) in comparison to land used by the company (m^2)	(b8) A biodiversity action plan is developed and implemented for all relevant sites (including manufacturing sites) to protect and enhance the local biodiversity'

3.1.6. Remanufacturing and high quality refurbishment of high value and/or large series products and components

Remanufacturing involves dismantling a product, restoring and replacing components and testing individual parts and whole product to ensure that meets the same quality standards as new products manufactured nowadays accompanied with an appropriate warranty. Refurbishment refers to used products that met their original quality standards when it was first introduced in the market i.e. the refurbished product achieves the quality standard level that was in place when it was firstly manufactured and actually not the one of the same product produced nowadays.

BEMP is to take into account and enable opportunities for remanufacturing or refurbishment of used fabricated metal products and bringing them into the market for reuse, when environmental benefits are proven under a full life cycle perspective. The remanufactured or refurbished products shall achieve at least the same quality levels they had when they were first introduced in the market and are sold with the appropriate warranty.

Applicability

The BEMP is applicable to all types of companies in this sector, including SMEs.

Remanufacturing or refurbishment may increase companies' operational costs, which are certainly outbalanced for manufacturing of high value products/components/parts and for large volume series.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i21) Percentage of saved raw material used for remanufacturing/refurbishment compared to producing a new product (kg of material to remanufacture/refurbish / kg of material for new product) (i22) Avoided greenhouse gas emissions associated with remanufacturing/refurbishing a product compared to producing a new one (CO2 equivalent emissions remanufacturing/refurbishing / CO2 emissions new product), specifying if scope 1, 2 and/or 3 are included	(b9) The company is offering remanufactured/refurbished products with LCA verified proven environmental benefits

3.1.7. Link to the Reference Documents on Best Available Techniques relevant for fabricated metal product manufacturing companies

It is BEMP for fabricated metal products manufacturing companies to consult the relevant Best Available Techniques[10] (BAT) described in the relevant Reference Documents on BAT (BREFs) to identify relevant environmental issues to address and, where appropriate, implement the techniques.

Applicability

Best Available Techniques (BAT) described in the relevant Reference Documents on BAT (BREFs) applies to large companies under the scope of Industrial Emissions Directive (IED)[11].

This BEMP is very relevant for the SMEs (below the IED threshold). However, the lack of technical knowledge or capacity (of SMEs) may constitute a limiting factor.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i23) Consideration of relevant BATs	N/A

3.2. BEMPs for optimisation of utilities

This section deals with practices for the supporting processes and is relevant for the fabricated metal products manufacturers.

3.2.1. Efficient ventilation

BEMP is to improve the efficiency of the ventilation system and reduce its energy use by:

performing a study of the manufacturing site, including buildings and processes; mapping the sources of heat, humidity, and pollutants to indoor air;

[10] [10] The full list of the existing developed BREFs is available here: http://eippcb.jrc.ec.europa.eu/reference/

[11] Directive 2010/75/EU of the European Parliament and of the Council: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:334:0017:0119:en:PDF

reducing these sources by e.g. implementing effective maintenance that limits emissions of pollutants or isolating a source thanks to an air pressure differential;
defining the actual (current and future) needs for ventilation;
carrying out an audit of the existing ventilation system, to compare the defined needs with the current installation;
re-designing the ventilation system to reduce its energy use and enhance energy recovery[12] ; used the recovered heat to drive cooling (air-conditioning system or for heating or pre-heating, install local renewables (solar thermal or solar PV to drive the cooling systems) and reduce the volume of air supplied (which reduces the energy use for heating or cooling it). Demand based ventilation can be designed to avoid peak draws and allow more energy efficient operation with down-sized equipment.

A similar approach can be also implemented for new installations, whereby the needs are defined on the designed building and processes and there is further opportunity to minimise them by influencing their design.

Applicability

The BEMP is applicable to all types of companies in this sector, including SMEs. Insufficient in-house technical knowledge can also sometimes constitute a barrier to implement all the elements of this BEMP.

The safety of the staff of the manufacturing facility must be set against the energy efficiency of the ventilation system in place.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i24) Effective air volume extracted from the building (m^3/hour, m^3/shift or m^3/production batch) (i25) Demand driven ventilation system (Y/N) (i26) Energy use for ventilation per m^3 building (m^3/hour, m^3/shift or m^3/production batch) (i27) Energy use to heat or to cool the air used for ventilation per m^3 building (m^3/hour, m^3/shift or m^3/production batch)	(b11) Demand driven ventilation is implemented to reduce HVAC energy use

3.2.2. Optimal lighting

In order to achieve optimal lighting in new built and existing manufacturing sites, a lighting study, to define the actual (current and future) light needs and a lighting plan, to define the optimal lighting solution (light systems, fittings, lamps, use of daylight, etc.) need to be carried out.

It is BEMP for manufacturers of fabricated metal products to optimise existing and new lighting systems by:

[12] E.g. recovering heating energy for building heating with a heat exchanger.

maximising the use of daylight;
installing presence detectors controlled lighting in key locations;
monitoring separately the energy use for lighting;
selecting the most appropriate energy efficient lamps in terms of their planned hours of use and area of installation;
implementing a regular plan for cleaning and maintenance for the lighting system.

Applicability

This BEMP is broadly applicable to all types of companies in the sector, including SMEs. However, it is more suitable for new built manufacturing sites or renovated production lines.

The natural lighting is an important element on efficient lighting systems, but its implementation may be limited to all locations due to local natural conditions. Similarly, its applicability may be limited to existing manufacturing sites due to architectural constraints.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i28) Use of daylight wherever possible (Y/N) (i29) Share of the lighting controlled by sensors (motion sensors, daylight sensors) (%) (i30) Energy use of lighting equipment (kWh/year/m² of lighted floor) (i31) Installed lighting power (kW/m² of lighted floor) (i32) Share of LED/low-energy light bulbs (%) (i33) Average efficacy of luminaires throughout plant (lm/W)	N/A

3.2.3. Environmental optimisation of cooling systems

BEMP is to systemically improve the energy efficiency and overall environmental performance of cooling systems for the machine shops of the manufacturing site by:

Striving to reduce the cooling demand;
Performing an audit of the cooling system in place in order to compare the defined needs with the current cooling installation;
Redesigning the cooling system with a focus on maximising energy and water efficiency and minimising GHG emissions

Applicability

The BEMP is applicable to all types of companies in this sector, including SMEs and it is more suitable for new built or renovated manufacturing sites.

However, the implementation of this BEMP may require support from external partners, which may constitute a possible barrier, especially for the SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i34) Total equivalent warming impact (TEWI) of the cooling system (CO_2^e) (i35) Global warming potential (GWP) of refrigerants used (CO_2^e) (i36) Energy use for cooling (kWh/year; kWh/kg finished product or manufactured part) (i37) Water use (tap water / rain water / surface water) for cooling (m^3/year; m^3/kg finished product or manufactured part)	N/A

3.2.4. Rational and efficient use of compressed air

BEMP is for fabricated metal product manufacturers to reduce their energy consumption associated with the use of compressed air in the manufacturing processes by the following measures:

Mapping and assessing the use of compressed air. When part of the compressed air is used in inefficient applications or in an inappropriate manner, other technological solutions may be more fit for purpose or more efficient. In case a switch from pneumatic tools to electricity-driven tools for a certain application is considered, a proper assessment, considering not just energy consumption but all environmental aspects as well as the specific needs of the application, needs to be carried out.

Optimising the compressed air system by:

identifying and eliminating leaks, using suitable control technology, such as ultrasound measuring instruments for air leaks that are hidden or difficult to access,

better matching of the supply and demand of compressed air within the manufacturing facility, i.e. matching the air pressure, volume and quality to the needs of the various end-use devices and, when appropriate, producing the compressed air closer to the consumption centres by choosing decentralised units rather than a large centralised compressor catering for all uses,

producing the compressed air at a lower pressure by decreasing the pressure losses in the distribution network and, when needed, adding pressure boosters only for devices that require higher pressure than most applications,

designing the compressed air system based on the annual load duration curve, in order to ensure supply with the minimum energy use over base, peak and minimal loads,

selecting highly efficient components for the compressed air system, such as highly efficient compressors, variable frequency drives and air dryers with integrated cold storage,

once all of the above is optimised, recovering the heat from the compressor(s) through the installation of a plate heat exchanger within the oil circuit of the compressors; the recovered heat can be employed in a variety of applications, such as the drying of products, regeneration of the

desiccant dryer, space heating, cooling thanks to the operation of an absorption chiller or converting the recovered heat into mechanical energy using Organic Rankine Cycle (ORC) machines.

Applicability

This BEMP is applicable to all types of companies in this sector, including SMEs. It is more suitable for new or renovated production lines.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i38) Electricity use per standard cubic meter of compressed air delivered at the point of end-use (kWh/m^3) at a stated pressure level (i39) Air leakage index[13]	(b12) The electricity use of the compressed air system is lower than 0.11 kWh/m^3 of delivered compressed air, for large installations working at 6.5 bars effective, with volume flow normalized on 1013 mbar and 20°C, and pressure deviations not exceeding 0.2 bars effective. (b13) After all air consumers are switched off, the network pressure remains stable and the compressors (on standby) do not switch to load condition.

3.2.5. Use of renewable energy

BEMP is for fabricated metal product manufacturing companies to use renewable energy for their processes by:

purchasing of verified renewable electricity or own generation of electricity from renewable energy sources;
generating heat from renewable energy sources (e.g. solar thermal, including concentrated solar thermal, geothermal or heat pumps that can also run on renewable electricity e.g. with solar PV, sustainable (waste based) biomass and biogas);
installing energy storage systems, including thermal storage complementing solar thermal, geothermal, ambient heat applications, including coupled with heat pumps for heating and cooling, where relevant, to enable higher rates of own use of self-generated renewable energy.

Applicability

[13] $Air\ Leakage\ Index = \frac{\sum_i t_{i(cr)} * C_{i(cr)}}{t_{(sb)} * C_{(tot)}}$, which is calculated when all air consumers are switched off as the sum for each of the compressors of the time it runs multiplied by the capacity of that compressor, divided by the total standby time and the total rated capacity of the compressors in the system

The BEMP is broadly applicable to all types of companies in this sector, including SMEs.
The own heat generation from renewables and integration in the fabrication processes, highly depends on the technological specificities of the carried out manufacturing processes and the actual demand e.g. high-temperature process.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i40) Share of electricity from renewable sources (self-generated or purchased) out of the total electricity use (%) (i41) Share of heat from renewable sources out of the total heat use (%)	(b14) All electricity use is met by self-generated renewable energy or purchased verified renewable electricity via a long-term power purchasing agreement from new production capacities. (b15) The use of renewable heat generated on-site is integrated in suitable manufacturing processes.

3.2.6. Rainwater collection

BEMP is to reduce freshwater use at manufacturing sites by collecting and using rainwater in the various manufacturing or ancillary processes. Such a system collects rainwater from a catchment area (often the roof of the manufacturing plant or the parking space), has a conveyance system to collect it in a storage tank and a distribution system (pipes and pump) to bring it to the final use points.

Applicability

The BEMP is broadly applicable to all types of companies in this sector, including SMEs. It is more suitable for new built or retrofitted plants and particularly to those plants where the collected rainwater can be used as process water. In case of retrofitting, the building characteristics may constitute a barrier to the implementation of the BEMP.

The geographical location highly influences the relevance of this BEMP (e.g. amount of precipitation, local water scarcity). In certain regions, the BEMP is compulsory by legislation for flood prevention and to reduce the use of ground water.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i42) Share of rainwater use on total water consumption (%)	(b16) Rainwater is collected and used as process water in manufacturing and ancillary processes

3.3. BEMPs for manufacturing processes

This section deals with practices for the core manufacturing processes and is relevant for the fabricated metal products manufacturers.

3.3.1. Selection of resource efficient metal working fluids

BEMP is to select resource efficient metal working fluids by:

carrying out systematic science-based in-depth assessments of available metal working fluids, according to a broad set of criteria, including both environmental and economic aspects, with consideration of the entire life cycle of the fluids and of the manufactured products.

looking for available metal working fluids that can provide different functions (e.g. lubrication, chip removal, cleaning) at the same time, or can be used more than once after appropriate recovery and/or reformulation.

BEMP is also to evaluate and control the performance of the selected metal working fluids during or after their application by means of a monitoring system.

Applicability

This BEMP is applicable to all types of companies in this sector, including SMEs. However, the lack of in-house technical knowledge can constitute a barrier, especially in SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i43) Total amount of metal working fluids purchased per year (kg (or l)/year) (i44) Total amount of recovered metal working fluids per year (kg (or l)/year) (i45) Number of different metal working fluids used in the company (total number of metal working fluids) (i46) Consumption of metal working fluids per manufactured product (kg (or l)/ kg finished product or manufactured part)	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product

3.3.2. Minimisation of lubricoolant consumption in metal processing

BEMP is to minimise the use of lubricoolants in metal processing and shaping operations. This can be achieved by applying techniques such as cryogenic cooling or high pressure lubricoolant supply. These techniques result in reduced waste generation, higher overall process efficiencies and consequently lower energy use as well as extended tool service life.

Applicability

This BEMP is broadly applicable to all types of companies in this sector, including SMEs. Due to its energy intensity, it is more suitable for small series or prototypes and for new or renewed installations rather than retrofitting on an ongoing process.

However, the energy intensity is a parameter that needs to be carefully examined on a case-by-case basis. This, in combination with the lack of in-house technical knowledge and expertise may constitute a significant barrier for the application of this BEMP.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i47) Consumption of lubricoolants per processed part (l/part)	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product

3.3.3. Incremental sheet metal forming as alternative for mould making

For the production of small series, it is BEMP to apply incremental sheet metal forming (ISF) as an alternative for mould making. This allows the manufacturing of complex products with a higher material efficiency.

Applicability

This BEMP is broadly applicable to all types of companies in the sector, including SMEs. ISF can be used for a wide variety of materials and it is more suitable for complex product geometries and for small series of production and prototypes. However, companies prior to switching to ISF technique, may carry out a life cycle assessment to understand environmental benefits.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i11) Energy use per manufactured product (kWh / kg finished product or manufactured part). (i1) Resource efficiency (kg finished product / kg of material input (i48) Environmental benefits of switching to ISF proven by a full LCA or a simplified LCA based on semi-quantitative analysis (Y/N).	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product.

3.3.4. Reduction of standby energy use of metal working machines

BEMP is to reduce the standby energy use of metal working machines by switching off (and on again) the machines in their most efficient way, either manually or automatically (re-programming the control system) or by purchasing more energy-efficient machines in which a “green” standby mode (with very low energy use) is

integrated. This operational way is often based on several subunits that can be switched off individually instead of putting the entire machine simply on standby. An additional approach is reducing the duration of standby phases, especially for machines with high energy use during downtime, through an optimisation of production planning.

Applicability

The BEMP is broadly applicable in all types of companies from the sector, including SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i11) Energy use per manufactured product (kWh / kg finished product or manufactured part) (i49) For individual relevant machines: total energy use per machine and year (kWh / year) (i50) For individual relevant machines: Energy use during downtime (kWh / hour) (i51) Percentage of machines having a switch-off / do-not-switch label (%)	(b18) All metal working machines have either a green standby mode or a label indicating when they should be manually switched off

3.3.5. Maintaining material value for metal residues

BEMP is to maintain material value by post-processing metal scrap (chips and swarf), in particular through two aspects of metal residue processing:

segregating flows of metal residues to ensure a high level of purity allowing further recovery and recycling at higher quality grades;
recovering and segregating cutting oil and metal, for instance by pressing chips and swarf into briquettes.

Applicability

This BEMP is applicable to all types of companies in this sector, including SMEs and more relevant for the production of large series.

The volume of material working residues must be significant to ensure economic feasibility.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	Benchmarks of excellence
(i52) Oil recovered (l oil / year) (i53) Oil resource efficiency (% of oil in briquettes or separator output)	(b19) Turning chips and grinding swarf have oil/moisture content respectively lower than 2% then 8%

3.3.6. Multi directional forging

When forging complex products with a high variation in cross-section, it is BEMP to apply multi-directional forging. This practice reduces significantly the formation of

flash by applying pressure in different directions in the piece under fabrication, resulting in less material needing to be removed by machining afterwards.

Applicability

This BEMP is broadly applicable to all types of companies in this sector, including SMEs. It is especially suitable for complexly formed components and niche products, and for companies with large production series. Multi-directional forging can be applied to a wide variety of materials (aluminium, copper, magnesium, titanium).

However, the applicability of this BEMP may be limited due to the need of purchasing special forging tools and technical knowledge which result in high investment cost.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i54) Percentage of generated flash per manufactured part (%) (i55) Total energy required for the forging process (energy input for forging kWh / kg finished product or manufactured part) (i1) Resource efficiency (kg finished product or manufactured part / kg of material input)	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product

3.3.7. Hybrid machining as a method to reduce energy use

BEMP is for fabricated metal product manufacturers to use hybrid machining if this allows a significant decrease in the total energy needs for machining per single part/product/component by combining two or more different manufacturing processes into a new setup exploiting synergistically the advantages of each individual process.

The combination of the various manufacturing processes e.g. milling, drilling can enable more freedom in the design and fabrication of parts, products, components when compared to the use of conventional machining technologies.

Applicability

Hybrid machining is broadly applicable to all types of companies in this sector, including SMEs. It is especially suitable for manufacturing sites that have new machines. Hybrid machining is very relevant for the manufacturing of parts/products/components with complex geometries.

The combination of relatively high investment costs and lack of in-house specific technical knowledge/capacity required to implement this BEMP may limit its applicability, especially in SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**

(i1) Resource efficiency (kg finished product or manufactured part / kg of material input) (i11) Energy use (kWh / kg finished product or manufacture part)	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product

3.3.8. Use of predictive control for paint booth HVAC management

BEMP is to minimise the energy use of the HVAC for pain booths by implementing a predictive control system, based on feedback and forward control, operating on a window of values. Such system allows keeping constant the speed at which the paint dries without necessarily maintaining constant the temperature and humidity levels in the paint booth, as is the case in conventional control systems. The working principle is keeping constant only the difference between the limit to how much vapour can be absorbed by the air (which varies with temperature) and the amount of water vapour already in the air.

Applicability

This BEMP is suitable for companies with large series of production, large paint booths and with multiple paint booths.

The full and effective implementation of the BEMP requires:

qualified employees with profound knowledge of the paint drying process and of paint quality control;

maintenance of the effectiveness of the installation;

reliable and continuous data monitoring (sensors, measuring, etc.) and automation systems in place (on-site).

The fulfilment of the increased above mentioned requirements in combination with the lack of in-house technical knowledge and high investment costs constitute a barrier to its implementation, especially for SMEs.

Associated environmental performance indicators and benchmarks of excellence

Environmental performance indicators	**Benchmarks of excellence**
(i56) Energy use for painting (kWh/m^2 of surface coated/painted)	(b17) The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured

	product - resource efficiency - consumption of metal working fluids per manufactured product

4. RECOMMENDED SECTOR-SPECIFIC KEY ENVIRONMENTAL PERFORMANCE INDICATORS

Table 4.1 lists a selection of key environmental performance indicators for the fabricated metal products manufacturing sector, together with the related benchmarks and reference to the relevant BEMPs. These are a subset of all the indicators mentioned in Section 3.

Table 4.1: Key environmental performance indicators and benchmarks of excellence for the fabricated metal products manufacturing sector

Indicator	**Common units**	**Main target group**	**Short description**	**Recommended minimum level of monitoring**	**Related EMAS core indicator[14]**	**Benchmark of excellence**	**Related BEMP[15]**
BEMPs for cross cutting issues							
Resource efficiency	kg finished products / kg input materials	Fabricated metal products manufacturers	Amount of finished manufactured products divided by the amount of input materials required for the manufacturing of finished products. The results of this indicator can help the application of approaches such as life cycle thinking, lean management and circular economy to assess the potential for environmental improvements in the manufacturing of existing or new metal products	Site	Material efficiency	Systematic consideration of life cycle thinking, lean management and circular economy in all strategic decisions making.	3.1.1, 3.3.3, 3.3.6, 3.3.7
Mapping of material flows and their environmental relevance	Y/N	Fabricated metal products manufacturers	This indicator refers to the mapping of all the flows of the materials used for the manufacturing of metal products in order to realise their environmental relevance.	Facility	Material efficiency	New products development are assessed for environmental improvements.	3.1.1

[14] EMAS core indicators are listed in Annex IV to Regulation (EC) No 1221/2009 (Section C.2).

[15] The numbers refer to the sections in this document.

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
Percentage of goods and services which are environmentally certified or with a verified reduced environmental impact.	%	Fabricated metal products manufacturers	Number of manufactured products or provided services with a verified reduced environmental impact divided by the total number of manufactured products or provided services.	Facility	Material efficiency	All purchased goods and services meet environmental criteria established by the company.	3.1.2
Use of by-products, residual energy or other resources from other companies.	kg materials from other companies / kg total input; MJ energy recovered from other companies / MJ total energy use	Fabricated metal products manufacturers	This indicator refers to the amount of used by-products or residual energy from other companies for the manufacturing of products or parts, divided by the total amount or energy inputs.	Company	Material efficiency	Collaboration with other organisations to use energy and resources more efficiently at systemic level.	3.1.2
Systematic stakeholder involvement with a focus on improved environmental performance	Y/N	Fabricated metal products manufacturers	This indicator refers to whether the involvement of stakeholders across the value chain in the development process of new products or parts with improved environmental performance is taking place systematically.	Company	Material efficiency	Structural engagement of stakeholders in the development of more environmentally friendly products.	3.1.2
Energy monitoring	Y/N	Fabricated metal	This indicator refers to the implementation of a systematic and	Site	Energy	Continuous energy monitoring at process level	3.1.3

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
system at process level		products manufacturers	detailed energy monitoring across manufacturing sites at process level.		efficiency	is implemented and driving energy efficiency improvements	
For individual chemicals used, amount of chemical applied and its classification according to Regulation 1272/2008 (CLP Regulation)	kg / kg finished product or manufactured part	Fabricated metal products manufacturers	Total amount of individual chemicals used in the manufacturing processes divided by the amount of finished product or manufactured part. The use of chemicals is reviewed periodically to explore substitution opportunities and are classified according to 1272/2008 EC CLP Regulation.	Site	Material efficiency	Regular (at least once a year) review the use of chemicals to minimise their use and explore opportunities for substitution	3.1.4
Implementation of a site biodiversity action plan in all manufacturing facilities	Y/N	Fabricated metal products manufacturers	This indicator refers to whether all manufacturing facilities have in place a biodiversity action plan for the site.	Site	Biodiversity	A biodiversity action plan is developed and implemented for all relevant sites (including manufacturing sites) to protect and enhance the local biodiversity'	3.1.5
Avoided greenhouse gas emissions associated with remanufacturing / refurbishing a product compared to producing a	GHG emissions remanufacturing / refurbishing / CO_2 emissions new product	Fabricated metal products manufacturers	This indicator refers to the avoided greenhouse gas emissions associated with remanufacturing or refurbishment of a product divided by the carbon dioxide emissions generated from the development of a new product. This indicator includes scope 1, 2 and 3	Site	Emissions	The company is offering remanufactured/refurbished products with LCA verified proven environmental benefits	3.1.6

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
new one, specifying if scope 1, 2 and/or 3 are included			greenhouse gas-emissions.				
BEMPs for optimisation of utilities							
Demand driven ventilation system	Y/N	Fabricated metal products manufacturers	This indicator refers to the installation and operation of demand driven ventilation systems in the manufacturing facilities.	Facility	Energy efficiency	Demand driven ventilation is implemented to reduce HVAC energy use	3.2.1
Effective air volume extracted from the building	m^3/hour m^3/shift m^3/production batch	Fabricated metal products manufacturers	Air volume extracted from the building per hour OR per shift OR per production batch	Site	Energy efficiency	N/A	3.2.1
Energy use of lighting equipment	kWh / year / m^2 of lighted floor	Fabricated metal products manufacturers	Energy use of the installed lighting equipment in the manufacturing facility divided by the surface of the lighted floor of the manufacturing facility per year.	Facility	Energy efficiency	N/A	3.2.2
Energy use for cooling	kWh/year kWh/kg finished product or manufactured part	Fabricated metal products manufacturers	Energy use of the cooling system in the manufacturing facility per year OR divided by the amount of finished product or manufactured part	Facility	Energy efficiency	N/A	3.2.3
Water use for	m^3/year	Fabricated	Volume of water used by the cooling	Facility	Water	N/A	3.2.3

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
cooling (tap water / rain water / surface water)		metal products manufacturers	system in the manufacturing facility per year. The type of water should be also reported e.g. tap/rain water.				
Electricity use per standard cubic meter of compressed air delivered at the point of end-use at a stated pressure level	kWh/m^3	Fabricated metal products manufacturers	Electricity use of the compressed air system (including the energy use of the compressors, dryers and secondary drives) per standard cubic metre of compressed air delivered, at a stated pressure level	Facility	Energy efficiency	The electricity use of the compressed air system is lower than 0.11 kWh/m^3 of delivered compressed air, for large installations working at 6.5 bars effective, with volume flow normalized on 1013 mbar and 20°C, and pressure deviations not exceeding 0.2 bars effective.	3.2.4
Air leakage index	Number	Fabricated metal products manufacturers	The Air Leakage Index is calculated when all air consumers are switched off as the sum for each of the compressors of the time it runs multiplied by the capacity of that compressor, divided by the total standby time and the total rated capacity of the compressors in the system, and it is expressed as:	Facility	Energy efficiency	After all air consumers are switched off, the network pressure remains stable and the compressors (on standby) do not switch to load condition.	3.2.4

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
			$Air\ Leakage\ Index = \frac{\sum_i t_{i(cr)} * C_{i(cr)}}{t_{(sb)} * C_{(tot)}}$ where: $t_{i(cr)}$ is the time (min) during which a compressor runs when all air consumers are switched off (standby of the compressed air system); $C_{i(cr)}$ is the capacity (Nl/min) of the compressor that switches on for the time $t_{i(cr)}$ while all air consumers are switched off; $t_{(sb)}$ is the total time (min) during which the installed compressed air equipment is in standby mode; $C_{(tot)}$ is sum of the rated capacity (Nl/min) of all the compressors in the compressed air system.				
Share of electricity from renewable sources (self-generated or purchased) out of the total electricity use	%	Fabricated metal products manufacturers	Electricity from renewable sources either self-generated or purchased divided by the total electricity use within the site. Purchased renewable electricity, it is only accounted for in this indicator if verified as additional (i.e. not already accounted for by another organisation or in the electricity mix of the grid).	Site	Energy efficiency	All electricity use is met by self-generated renewable energy or renewable electricity purchased with verified additionality.	3.2.5
Share of heat from renewable sources out of the total heat use	%	Fabricated metal products manufacturers	Heat from renewable sources (e.g. solar thermal, geothermal, heat pumps, waste based biomass and biogas, renewable electricity, preferably generated locally as part of self-consumption or a renewable	Site	Energy efficiency	The use of renewable heat generated on-site is integrated in suitable manufacturing processes.	3.2.5

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
			community based approach) divided by the total use of heat by the site				
Share of rainwater consumption on total water consumption	%	Fabricated metal products manufacturers	Total volume of rainwater consumed for on-site or ancillary processes divided by the total volume of water consumed for on-site or anciliary process in the manufacturing sites.	Site	Water	Rainwater is collected and used as process water in manufacturing and ancillary processes	3.2.6
BEMPs for manufacturing processes							
Total amount of metal working fluids purchased per year	Kg/year L/year	Fabricated metal products manufacturers	Amount of metal working fluids used in the manufacturing processes of the manufacturing site per year.	Site	Material efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	3.3.1
Consumption of metal working fluids per manufactured	kg (or l)/ kg finished product or manufactured part	Fabricated metal products manufacturers	Amount of metal working fluids consumed in the manufacturing processes divided by the amount of finished products or manufactured parts	Site	Material efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance	3.3.1

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
product						as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	
Consumption of lubricoolants per processed part	L / manufactured part	Fabricated metal products manufacturers	Volume of lubricoolants consumed in the manufacturing processes/operations per manufactured part.	Site	Material efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	3.3.2
Energy use	kWh / kg finished product or manufactured	Fabricated metal products	Energy use in the manufacturing facility for the manufacturing of products or parts divided by the amount of finished product	Facility	Energy efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance	3.1.3, 3.3.3,

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
	part	manufacturers	or manufactured part.			as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	3.3.4, 3.3.7
For individual relevant machines: energy use during downtime	kWh / hour	Fabricated metal products manufacturers	Amount of energy used by the machines during downtime per hour	Facility	Energy efficiency	All metal working machines have either a green standby or a label indicating when they should be manually switched off	3.3.4
Oil recovered	L oil / year	Fabricated metal products manufacturers	Volume of cutting oils recovered from the manufacturing processes per year	Facility	Material efficiency	Turning chips and grinding swarf have oil/moisture content respectively lower than 2% then 8%	3.3.5
Total energy required for the forging process	Energy input for forging kWh / kg finished product or manufactured part	Fabricated metal products manufacturers	Total energy required for the forging process divided by the amount of finished product or manufactured part	Facility	Material efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators:	3.3.6

Indicator	Common units	Main target group	Short description	Recommended minimum level of monitoring	Related EMAS core indicator[14]	Benchmark of excellence	Related BEMP[15]
						- energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	
Energy use for painting	kWh/m^2 of surface coated/painted	Fabricated metal products manufacturers	Energy use for painting of the products/parts divided by the surface of the coated or painted manufactured products or parts.	Site	Energy efficiency	The company achieves continuous (i.e. year-on-year) improvement in environmental performance as reflected by an improvement in, at least, the following indicators: - energy use per manufactured product - resource efficiency - consumption of metal working fluids per manufactured product	3.3.8