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Chapter 2

Review of Directives, Regulations and Standards Related to Sustainable Product Design and Manufacture



Jose L. Casamayor and Daizhong Su

Abstract This chapter reviews the main directives, regulations and standards relevant to the design and manufacture of sustainable products. Product designers and manufacturers have to be aware of these, because some of these are mandatory in some countries (e.g. EU countries) and others can contribute significantly to reduce the environmental and social impact of products, thus making the products more sustainable. The chapter begins by providing a general introduction about regulations, directives and standards and their importance. It then continues with a description of the main directives, regulations and standards that are relevant to sustainable design and manufacturing. Finally it is explained how directives, regulations and standards are applied in design and development processes.

Keywords Regulations · Directives · Standards · Sustainability · Product design · Manufacture

2.1 Introduction

Some directives, regulations and standards can contribute to reduce the environmental and social impact of products, and hence contribute to make the products more sustainable. This chapter will review the existing directives, regulations and standards that, directly or indirectly, contribute to design and manufacture of products in a more sustainable manner.

Directives lay down certain results or targets (e.g. reduction of CO₂ levels per year) that must be achieved, but each country affected by these directives is free to

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15

21 decide how to transpose directives into national laws. In the case of sustainability-
22 related directives, these targets are usually related with environmental indicators such
23 as CO₂ levels or waste amount in some countries (USDA 2018).

24 **Regulations** have binding legal force, and enter into force on a set date in the
25 countries where they apply (USDA 2018).

26 **Standards** are an agreed way of doing somethings. It could be about making a
27 product, managing a process, delivering a service or supplying materials. Standards
28 can cover a vast range of activities undertaken by organizations and used by their
29 customers. The point of a standard is to provide a reliable basis for people to share the
30 same expectations about a product or service. This helps to facilitate trade, provide
31 a framework for achieving economies, efficiencies and interoperability and enhance
32 consumer protection and confidence (BSI 2018).

33 Although directives do not have to be complied by law, they are usually translated
34 into national laws, which have binding legal force, like regulations. However, the
35 adoption and application of standards is voluntary, although they must to be followed
36 to obtain some certifications or sustainable labels.

37 It is important that manufacturers, and product developers are aware of the reg-
38 ulations and directives applicable to the category of products they develop and pro-
39 duce in different geographical areas (i.e. country), so they can design and manu-
40 facture their products to comply with these to avoid fines as well as to reduce their
41 environmental-social impact.

42 Although standards, unlike regulations and directives, are not compulsory, they
43 are required to conduct tests to obtain certain certifications (i.e. eco-labels, quality
44 labels), so they can, indirectly, contribute to reduce the environmental-social impact
45 of products too.

46 In the following sections, the directives, regulations and standards which have
47 been created to reduce the environmental and social impacts of products and the
48 standards that can directly or indirectly contribute to reduce the environmental impact
49 of products are discussed.

50 2.2 Directives

51 AQ2 51 Nine directives are reviewed in this section (Table 2.1), which are related to the
52 areas of energy consumption, product development, waste, resources, recycle/reuse,
53 restriction in use of hazardous, pollutant emissions and environmental impact assess-
54 ment. Each directive's related key areas are listed in the Table 2.1, while more detailed
55 information of the directives is presented after the table.

Table 2.1 List of directives

Directives	Related key areas
(1) Energy labelling directive 2010/30/EU (EC 2010b)	Energy consumption, product development
(2) Energy-related Products (ErP) Directive 2009/125/EC (EC, 2009a, b)	Energy consumption, product development
(3) Eco-design directive 2009/125/EC (EC 2009a, b)	Energy consumption, product development, waste, resources, recycle/reuse
(4) Waste Electrical and Electronic Equipment recycling (WEEE) directive 2012/19/EC (EC 2012a, b)	Waste, recycle/reuse of electronic products/equipment
(5) Waste Framework Directive 2008/98/EC (EC 2008)	Waste, recycle/reuse
(6) Restriction of Hazardous Substances (RoHS) directive 2011/65/EC (EC 2011)	Restriction to use hazardous in products
(7) Packaging and Packaging waste directive 94/62/EC (EC 1994)	Product packaging, recycle/reuse, waste
(8) Industrial Emissions Directive (IED) Directive 2010/75/EU (EC 2010a)	Regulating industrial pollutant emissions
(9) Environmental Impact Assessment (EIA) Directive 2014/52/EC (EC 1985)	Environmental impact assessment framework

2.2.1 Energy Labelling Directive 2010/30/EU (EC 2010b)

The Energy Labelling Directive (2010/30/EC) establishes a framework for labelling and consumer information regarding energy consumption. Initially established for household appliances, the scope of the Directive has been extended to energy-related products, which are likely to have a direct or indirect impact on the consumption of energy and potentially of other resources during use.

The Energy Labelling Directive is a framework directive that mandates the Commission to propose, by means of delegated acts, details relating to information to be provided on the label and in the fiche for each type of product. Products are ranked, according to their energy consumption, on an A to G scale with colours from dark green to red. The implementation of the Energy Labelling Directive is linked to the Eco-design Directive (2009/125/EC). Requirements and benchmarks defined for individual product group under the Eco-design Directive are used as references for setting the energy labelling classes.

70 **2.2.2 Energy-Related Products (ErP) Directive 2009/125/EC** 71 **(EC 2009a, b)**

72 The aim of this directive is to improve energy efficiency and environmental pro-
73 tection, it applies to products that affect energy consumption throughout their life
74 cycle.

75 This directive does not introduce directly binding requirements for specific prod-
76 uct categories, but rather outlines the conditions and criteria relating to environmental
77 characteristics of products, such as energy and water waste, or lifespan, so they can
78 be improved quickly and efficiently. It encourages manufacturers and/or importers to
79 offer products designed to reduce their overall impact on the environment, including
80 the resources consumed during manufacture and disposal.

81 It applies to energy-related products that meet the following criteria: Are sold in
82 high quantities (over 200,000 units/year in the EU), have a significant environmental
83 impact and have a potential for improvement.

84 **2.2.3 Eco-design Directive 2009/125/EC (EC 2009a, b)**

85 The aim of the Eco-design Directive is to reduce (at the design stage) the energy
86 consumption and other negative environmental impacts of products. Although the
87 primary aim is to reduce energy use, it is also aimed to consider other factors that
88 may influence the environmental impact of the product such as: Materials use, water
89 use, polluting emissions, waste issues and recyclability.

90 **2.2.4 Waste Electrical and Electronic Equipment Recycling** 91 **(WEEE) Directive 2012/19/EC (EC 2012a, b)**

92 The WEEE directive require producers and distributors to finance the collection,
93 treatment and recycling or reuse of Electrical and Electronic Equipment.

94 The aim of this directive is to address the environmental impacts of WEEE and to
95 encourage its separate collection and subsequent treatment, reuse, recovery, recycling
96 and environmentally sound disposal.

97 It affects any importer, re-branders or manufacturer of products that requires elec-
98 tricity for its main purpose. These will have to finance the cost of: Collecting, treating
99 (i.e.: mercury in lamps, Printed Circuit Board (PCB) in ballasts, etc.), recovering
100 and recycling products imported, re-branded or manufactured. For these purposes
101 all these products should be marked.

102 **2.2.5 Waste Framework Directive 2008/98/EC (EC 2008)**

103 It builds a legal framework for treating waste in the EU. It sets the basic concepts
 104 and definitions related to waste management, such as definitions of waste, recycling,
 105 recovery. It explains when waste ceases to be waste and becomes a secondary raw
 106 material (so called end-of-waste criteria), and how to distinguish between waste and
 107 by-products. The Directive lays down some basic waste management principles: it
 108 requires that waste be managed without endangering human health and harming
 109 the environment, and in particular without risk to water, air, soil, plants or animals,
 110 without causing a nuisance through noise or odours, and without adversely affecting
 111 the countryside or places of special interest. Waste legislation and policy of the
 112 EU Member States shall apply as a priority order the following waste management
 113 hierarchy: (1) Prevention (non-waste), (2) re-use of waste, (3) recycling of waste, (4)
 114 recovery of waste, and (5) disposal of waste.

115 This directive introduces the ‘polluter pays principle’ and the ‘extended pro-
 116 ducer responsibility’. It incorporates provisions on hazardous waste and waste oils
 117 and includes two new recycling and recovery targets to be achieved by 2020: 50%
 118 preparing for re-use and recycling of certain waste materials from households and
 119 other origins similar to households, and 70% preparing for re-use, recycling and other
 120 recovery of construction and demolition waste. The Directive requires that Member
 121 States adopt waste management plans and waste prevention programmes.

122 **2.2.6 Restriction of Hazardous Substances (RoHS) Directive** 123 **2011/65/EC (EC 2011)**

124 This directive prevents all new electrical and electronic equipment placed on the mar-
 125 ket in the European Economic Area from containing lead, mercury, cadmium, hex-
 126 a-valent chromium, poly-brominated biphenyls (PBB) or polybrominated diphenyl
 127 ethers (PBDE), except in certain specific applications, in concentrations greater than
 128 the values decided by the European Commission. These values have been established
 129 as 0.01% by weight per homogeneous material for cadmium and 0.1% for the other
 130 five substances.

131 It draws its scope of application from that of the Waste Electrical and Electronic
 132 Equipment (WEEE) Directive, with a few exceptions. The WEEE Directive specifies
 133 ten broad product categories: (1) Large household appliances, (2) Small household
 134 appliances, (3) IT and telecommunications equipment, (4) Consumer equipment, (5)
 135 Lighting equipment, (6) Electrical and electronic tools (with the exception of large-
 136 scale stationary industrial tools), (7) Toys, leisure and sports equipment, (8) Medical
 137 devices (with the exception of all implanted and infected products), (9) Monitoring
 138 and control instruments, and (10) Automatic dispensers. Groups 8 and 9 were not
 139 within scope of the RoHS 1 but are being included within the scope of RoHS 2,

140 these will be phased in completely by 2019. Also ‘Light bulbs and luminaries in
 141 households’ have been included in the scope of the RoHS Directive, although they
 142 are not within the scope of the WEEE Directive.

143 **2.2.7 Packaging and Packaging Waste Directive 94/62/EC** 144 **(EC 1994)**

145 This directive affects any type of product that uses any type (primary/secondary)
 146 of packaging. Its main objectives are: Reduce packaging material excess, elim-
 147 inate/avoid specific hazardous substances/materials, inform the consumers about
 148 the content of product/packaging, reduce the amount of waste at end of life of the
 149 packaging, increase/promote the re-use and recycle of packaging waste and inform
 150 the producer/manufacturer about their responsibility to recuperate and recycle its
 151 packaging.

152 **2.2.8 Industrial Emissions Directive (IED) Directive** 153 **2010/75/EU (EC 2010a)**

154 This directive aims to achieve a high level of protection of human health and the
 155 environment taken as a whole by reducing harmful industrial emissions across the
 156 EU, in particular through better application of Best Available Techniques (BAT). It
 157 is the main EU instrument regulating pollutant emissions. IED is based on several
 158 pillars: (1) an integrated approach, (2) use of best available techniques, (3) flexibility,
 159 (4) inspections and (5) public participation.

- 160 (1) The integrated approach means that the permits must take into account the whole
 161 environmental performance of the plant, covering e.g. emissions to air, water
 162 and land, generation of waste, use of raw materials, energy efficiency, noise,
 163 prevention of accidents, and restoration of the site upon closure.
- 164 (2) The permit conditions including emission limit values must be based on the
 165 Best Available Techniques (BAT). In order to define BAT and the BAT-associated
 166 environmental performance at EU level, the Commission organises an exchange
 167 of information with experts from Member States, industry and environmental
 168 organisations. This work is co-ordinated by the European IPPC Bureau of the
 169 Institute for Prospective Technology Studies at the EU Joint Research Centre in
 170 Seville (Spain). This process results in BAT Reference Documents (BREFs); the
 171 BAT conclusions contained are adopted by the Commission as Implementing
 172 Decisions. The IED requires that these BAT conclusions are the reference for
 173 setting permit conditions.
- 174 (3) The IED allows competent authorities some flexibility to set less strict emission
 175 limit values. This is possible only in specific cases where an assessment shows

- 176 that achieving the emission levels associated with BAT described in the BAT
177 conclusions would lead to disproportionately higher costs compared to the envi-
178 ronmental benefits due to the geographical location or the local environmental
179 conditions or the technical characteristics of the installation.
- 180 (4) The IED contains mandatory requirements on environmental inspections. Mem-
181 ber States shall set up a system of environmental inspections and draw up inspec-
182 tion plans accordingly. The IED requires a site visit to take place at least every
183 1 to 3 years, using risk-based criteria.
- 184 (5) The IED ensures that the public has a right to participate in the decision-making
185 process, and to be informed of its consequences, by having access to permit
186 applications, permits and the results of the monitoring of releases.

187 **2.2.9 Environmental Impact Assessment (EIA) Directive** 188 **2014/52/EC (EC 1985)**

189 This directive is in force since 1985 and applies to a wide range of defined public and
190 private projects, which are defined in Annexes I and II. Its objective is to simplify the
191 procedures for assessing environmental impact, define timeframes for the different
192 stages of environmental assessment, and improve the quality, transparency of EIA
193 reports. All projects listed in Annex I are considered as having significant effects
194 on the environment and require an EIA (e.g. long-distance railway lines, motorways
195 and express roads, airports with a basic runway length ≥ 2100 m, installations for the
196 disposal of hazardous waste, installations for the disposal of non-hazardous waste
197 >100 tonnes/day, waste water treatment plants >150.000 p.e.), and therefore are
198 considered as mandatory EIA.

199 For projects listed in Annex II, the national authorities have to decide whether an
200 EIA is needed (i.e. the need of an EIA is decided at discretion of Member States).
201 This is done by the 'screening procedure', which determines the effects of projects on
202 the basis of thresholds/criteria or a case by case examination. However, the national
203 authorities must take into account the criteria laid down in Annex III. The projects
204 listed in Annex II are in general those not included in Annex I (i.e. railways, roads
205 waste disposal installations, waste water treatment plants), but also other types such
206 as urban development projects, flood-relief works.

207 **2.3 Regulations**

208 This section reviews two regulations, which are related to 'Eco-Management and
209 Audit Scheme' and 'Eco-Labels'.

210 **2.3.1 Eco-Management and Audit Scheme Regulation**
 211 **(EMAS) (EC) No 1221/2009 (EC 2009c)**

212 It is a management instrument developed by the European Commission for com-
 213 panies and other organisations to evaluate, report, and improve their environmental
 214 performance. EMAS is open to every type of organisation eager to improve its envi-
 215 ronmental performance. It spans all economic and service sectors and is applicable
 216 worldwide.

217 EMAS supports organisations in finding the right tools to improve their environ-
 218 mental performance. The organisations that voluntarily participate, commit to, both
 219 evaluating and reducing, their environmental impact. Third party verification guaran-
 220 tees the external and independent nature of the EMAS registration process. Providing
 221 publicly available information on an organisation's environmental performance is an
 222 important aspect of EMAS. Organisations achieve greater transparency both exter-
 223 nally, through the environmental statement, and internally through employees' active
 224 involvement.

225 EMAS can help to reduce the environmental impact of the company, strengthen
 226 legal compliance and employee involvement, and save resources and money. The
 227 key benefits of EMAS are: (1) Enhanced credibility, transparency and reputation, (2)
 228 Enhanced environmental risks and opportunities management, (3) Enhanced envi-
 229 ronmental and financial performance, and (4) Enhanced employee empowerment
 230 and motivation.

231 **2.3.2 Eco-Label Regulation (EC) No 66/2010 (EC 2010c)**

232 It concerns the European Union (EU) Ecolabel which is a voluntary environmental
 233 labelling scheme.

234 It enables consumers, by means of transparent ecological criteria, to make
 235 conscious choices without compromising on the quality of the products.

236 It may be awarded to products and services which have a lower environmental
 237 impact than other products in the same group. The label criteria were devised using
 238 scientific data on the whole of a product's life cycle, from product development to
 239 disposal. The label is awarded in consideration of European environmental and ethical
 240 objectives. It also promotes the EU's transition to a circular economy, supporting both
 241 sustainable production and consumption.

242 The label may be awarded to all goods or services distributed, consumed or used
 243 on the EU market whether in return for payment or free of charge, on condition that
 244 the ecological criteria have been clearly established. It does not apply to medicinal
 245 products for human or veterinary use, or to medical devices.

246 The system was introduced by Regulation (EEC) No 880/92 and amended by
 247 Regulation (EC) No 1980/2000. This Regulation (EC) No 66/2010 aims to improve
 248 the rules on the award, use and operation of the label.

2.4 Standards

Two types of standards, IEC and ISO, are reviewed in this section. The former is about design for electrical and electronic products, while the latter consists of 25 standards, including four standards regarding environmental management systems, five standards regarding environmental labels and declarations, 12 standards related to specific topics of environmental management, and four standards about greenhouse gases. The standards are listed in Table 2.2 and further reviewed in this section after the table.

2.4.1 IEC 62430:2009 Standard of ‘Environmentally Conscious Design for Electrical and Electronic Products’ (IEC 2009)

It applies to all the electrical/electronic products. This international standard provides a set of requirements for the process of environmentally conscious design reflecting the contents of IEC Guide 114 and ISO/TR 14062. This International Standard is intended for use by all those involved in the design and development of electrical and electronic products. To ensure consistency throughout the electro-technical sector the use of this standard as a base reference is encouraged.

2.4.2 The ISO 14000 Family of ‘Environmental Management’ Related Standards

The standards of this family provide practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities, facilitating sustainable product design and manufacturing. 25 standards are reviewed within this family, which are grouped into four groups: four standards of Environmental management systems, five standards of environmental labels and declarations, 12 standards of environmental management specific topics, and four standards of greenhouse gases, as further detailed below.

2.4.2.1 Environmental Management Systems

This group of four standards cover the following aspects: Requirements with guidance for use, general guidelines on implementation, guidelines for the phased implementation of an environmental management system, and guidelines for incorporating eco-design, as with further information presented below:

Table 2.2 List of standards

2.4.1 IEC standard	
IEC 62430:2009	Environmentally conscious design for electrical and electronic products
2.4.2 ISO 14000 Standards ‘Environmental Management’	
<i>2.4.2.1 Environmental management systems</i>	
ISO 14001:2015	Environmental management systems: Requirements with guidance for use
ISO 14004:2016	Environmental management systems: General guidelines on implementation
ISO 14005:2010	Environmental management systems: Guidelines for the phased implementation of an environmental management system, including the use of environmental performance evaluation
ISO 14006:2011	Environmental management systems: Guidelines for incorporating eco-design
<i>2.4.2.2 Environmental labels and declarations</i>	
ISO 14020:2000	Environmental labels and declarations: General principles
ISO 14021:2016	Environmental labels and declarations: Self-declared environmental claims (Type II environmental labelling)
ISO 14024:2018	Environmental labels and declarations: Type I environmental labelling: Principles and procedures
ISO 14025:2006	Environmental labels and declarations: Type III environmental declarations: Principles and procedures
ISO 14026:2017	Environmental labels and declarations: Principles, requirements and guidelines for communication of footprint information
<i>2.4.2.3 Environmental management</i>	
(1) Standards of miscellaneous topics related to environmental management	
ISO 14031:2013	Environmental management: Environmental performance evaluation: Guidelines
ISO/TS 4033:2012	Environmental management: Quantitative environmental information: Guidelines and examples
ISO 14034:2016	Environmental management: Environmental technology verification (ETV)
ISO 14063:2006	Environmental management: Environmental communication: Guidelines and examples
ISO 14045:2012	Environmental management: Eco-efficiency assessment of product systems: Principles, requirements and guidelines
(2) Water footprints	
ISO 14046:2014	Environmental management: Water footprint: Principles, requirements and guidelines
ISO/TR 14073:2017	Environmental management: Water footprint: Illustrative examples on how to apply ISO 14046

(continued)

Table 2.2 (continued)

(3) Life cycle assessment	
ISO 14044:2006	Environmental management: Life cycle assessment: Requirements and guidelines
ISO/TR 14047:2012	Environmental management: Life cycle assessment: Illustrative examples on how to apply ISO 14044 to impact assessment situations
ISO/TS 14048:2002	Environmental management: Life cycle assessment: Data documentation format
ISO/TR 14049:2012	Environmental management: Life cycle assessment: Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis
ISO/TS 14072:2014	Environmental management: Life cycle assessment: Requirements and guidelines for organizational life cycle assessment
2.4.2.4 Greenhouse gases	
ISO 14064-1:2006	Greenhouse gases: Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
ISO 14064-2:2006	Greenhouse gases: Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements
ISO/TS 14067:2013	Greenhouse gases: Carbon footprint of products: Requirements and guidelines for quantification and communication
ISO/TR 14069:2013	Greenhouse gases: Quantification and reporting of greenhouse gas emissions for organizations: Guidance for the application of ISO 14064-1

- 280 • *ISO 14001:2015—Environmental management systems: Requirements with guid-*
 281 *ance for use (ISO 2015):*

282 It specifies the requirements for an environmental management system that an orga-
 283 nization can use to enhance its environmental performance. It is intended for use by
 284 an organization seeking to manage its environmental responsibilities in a systematic
 285 manner that contributes to the environmental pillar of sustainability. It helps an orga-
 286 nization achieve the intended outcomes of its environmental management system,
 287 which provide value for the environment, the organization itself and interested parties.
 288 Consistent with the organization's environmental policy, the intended outcomes
 289 of an environmental management system include: (1) enhancement of environmen-
 290 tal performance, (2) fulfilment of compliance obligations, and (3) achievement of
 291 environmental objectives.

292 This standard is applicable to any organization, regardless of size, type and nature,
 293 and applies to the environmental aspects of its activities, products and services that the
 294 organization determines it can either control or influence considering a life cycle per-
 295 spective. However, this standard does not state specific environmental performance
 296 criteria. This standard can be used in whole or in part to systematically improve
 297 environmental management.

- 298 • *ISO 14004:2016—Environmental management systems: General guidelines on*
 299 *implementation (ISO 2016a):*

300 It provides guidance for an organization on the establishment, implementation, main-
 301 tenance and improvement of a robust, credible and reliable environmental manage-
 302 ment system. The guidance provided is intended for an organization seeking to man-
 303 age its environmental responsibilities in a systematic manner that contributes to the
 304 environmental pillar of sustainability. The guidance in this International Standard
 305 can help an organization to enhance its environmental performance and enables the
 306 elements of the environmental management system to be integrated into its core
 307 business process.

308 This standard is applicable to any organization, regardless of size, type and nature,
 309 and applies to the environmental aspects of its activities, products and services that
 310 the organization determines it can either control or influence, considering a life cycle
 311 perspective.

312 The guidance in this International Standard can be used in whole or in part to
 313 systematically improve environmental management. It serves to provide additional
 314 explanation of the concepts and requirements.

- 315 • *ISO 14005:2010—Environmental management systems: Guidelines for the*
 316 *phased implementation of an environmental management system, including the*
 317 *use of environmental performance evaluation (ISO 2010):*

318 It provides guidance for all organizations, but particularly small and medium-sized
 319 enterprises, on the phased development, implementation, maintenance and improve-
 320 ment of an environmental management system. It also includes advice on the
 321 integration and use of environmental performance evaluation techniques.

322 It is applicable to any organization, regardless of its level of development, the
 323 nature of the activities undertaken or the location at which they occur.

- 324 • *ISO 14006:2011—Environmental management systems: Guidelines for incorpo-*
 325 *rating eco-design (ISO 2011):*

326 It provides guidelines to assist organizations in establishing, documenting, imple-
 327 menting, maintaining and continually improving their management of eco-design as
 328 part of an environmental management system (EMS). It is intended to be used by
 329 those organizations that have implemented an EMS in accordance with ISO 14001,
 330 but can help in integrating eco-design in other management systems. The guidelines
 331 are applicable to any organization regardless of its size or activity. It applies to those
 332 product-related environmental aspects that the organization can control and those
 333 it can influence. It does not establish by itself specific environmental performance
 334 criteria, and is not intended for certification purposes.

335 It is applicable to any organization, regardless of size, type and nature, and applies
 336 to the environmental aspects of its activities, products and services that the organiza-
 337 tion determines it can either control or influence considering a life cycle perspective.
 338 However, it does not state specific environmental performance criteria. It can be used
 339 in whole or in part to systematically improve environmental management. Claims

340 of conformity to ISO 14001:2015, however, are not acceptable unless all its require-
 341 ments are incorporated into an organization's environmental management system
 342 and fulfilled without exclusion.

343 2.4.2.2 Environmental Labels and Declarations

344 This group of five standards cover the following aspects: General principles, Self-
 345 declared environmental claims (Type II environmental labelling), Types I and III
 346 environmental labelling (Principles and procedures), and Principles, requirements
 347 and guidelines for communication of footprint information, with further information
 348 presented below:

- 349 • *ISO 14020:2000—Environmental labels and declarations: General principles*
 350 *(ISO 2000):*

351 This International Standard establishes guiding principles for the development and
 352 use of environmental labels and declarations. It is intended that other applicable
 353 standards in the ISO 14020 series be used in conjunction with this International
 354 Standard. This International Standard is not intended for use as a specification for
 355 certification and registration purposes.

- 356 • *ISO 14021:2016—Environmental labels and declarations: Self-declared environ-*
 357 *mental claims (Type II environmental labelling) (ISO 2016b):*

358 This standard specifies requirements for self-declared environmental claims (Type II
 359 environmental labels), including statements, symbols and graphics, regarding prod-
 360 ucts. It further describes selected terms commonly used in environmental claims and
 361 gives qualifications for their use. It also describes a general evaluation and verifi-
 362 cation methodology for self-declared environmental claims and specific evaluation
 363 and verification methods for the selected claims in this international standard. It
 364 does not preclude, override, or in any way change, legally required environmental
 365 information, claims or labelling, or any other applicable legal requirements.

- 366 • *ISO 14024:2018—Environmental labels and declarations: Type I environmental*
 367 *labelling: Principles and procedures (ISO 2018):*

368 It establishes the principles and procedures for developing Type I environmental
 369 labelling programmes, including the selection of product categories, product envi-
 370 ronmental criteria and product function characteristics, and for assessing and demon-
 371 strating compliance. It also establishes the certification procedures for awarding the
 372 label.

- 373 • *ISO 14025:2006—Environmental labels and declarations: Type III environmental*
 374 *declarations: Principles and procedures (ISO 2006a):*

375 It establishes the principles and specifies the procedures for developing Type III
 376 environmental declaration programmes and Type III environmental declarations. It

specifically establishes the use of the ISO 14040 series of standards in the development of Type III environmental declaration programmes and Type III environmental declarations.

This standard establishes principles for the use of environmental information, in addition to those given in ISO 14020:2000.

Type III environmental declarations as described in this standard are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded.

- *ISO 14026:2017—Environmental labels and declarations: Principles, requirements and guidelines for communication of footprint information (ISO 2017a):*

It provides principles, requirements and guidelines for footprint communications for products addressing areas of concern relating to the environment. It also provides requirements and guidelines for footprint communication programmes, as well as requirements for verification procedures. It does not address the quantification of a footprint, nor does it address the communication of footprints that are not related to the environment, e.g. footprints addressing social or economic issues. In particular, footprint communications relating to the economic and social dimensions of sustainable development are outside the scope of this standard. Footprint communications relating to organizations are also outside the scope of this standard.

2.4.2.3 Environmental Management

This group of standards are reviewed in three sub-groups: (1) five standards of miscellaneous topics which cover ‘Environmental performance evaluation: Guidelines’, ‘Quantitative environmental information: Guidelines and examples’, ‘Environmental technology verification’, ‘Environmental communication: Guidelines and examples’, and ‘Eco-efficiency assessment of product systems: Principles, requirements and guidelines’; (2) two standard about water footprint, including ‘Illustrative examples on how to apply ISO 14046’ and ‘Principles, requirements and guidelines’; and (3) five standards of lifecycle assessment covering the following aspects: ‘Principles and framework’, ‘Requirements and guidelines’, ‘Data documentation format’, ‘Illustrative examples on how to apply ISO 14044 to impact assessment situations’, ‘Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis, and ‘Requirements and guidelines for organizational life cycle assessment’. Further information of the standard is presented below.

(1) *Standards of miscellaneous topics related to environmental management*

- *ISO 14031:2013—Environmental management: Environmental performance evaluation: Guidelines (ISO 2013a):*

It gives guidance on the design and use of Environmental Performance Evaluation (EPE) within an organization. It is applicable to all organizations, regardless of type, size, location and complexity.

416 It does not establish environmental performance levels.

417 The guidance in this standard can be used to support an organization's own
418 approach to EPE, including its commitments to compliance with legal and other
419 requirements, the prevention of pollution, and continual improvement.

- 420 • *ISO/TS 14033:2012—Environmental management: Quantitative environ-*
421 *mental information: Guidelines and examples (ISO 2012a):*

422 It supports the application of standards and reports on environmental man-
423 agement. It provides guidelines on how to acquire quantitative environmental
424 information and data and implement methodology. It gives guidelines to organi-
425 zations on general principles, policy, strategy and activities necessary to obtain
426 quantitative environmental information for internal and/or external purposes.
427 Such purposes can be, for example, to establish inventory routines and support
428 decision making related to environmental policies and strategies, aimed in par-
429 ticular at comparing quantitative environmental information. The information
430 is related to organizations, activities, facilities, technologies or products.

431 It addresses issues related to defining, collecting, processing, interpreting
432 and presenting quantitative environmental information. It provides guidelines
433 on how to establish accuracy, verifiability and reliability for the intended use. It
434 utilizes proven and well-established approaches for the preparation of informa-
435 tion adapted to the specific needs of environmental management. It is applica-
436 ble to all organizations, regardless of their size, type, location, structure, activities,
437 products, level of development and whether or not they have an environmental
438 management system in place.

439 It supplements the contents of other International Standards on environmental
440 management.

- 441 • *ISO 14034:2016—Environmental management: Environmental technology*
442 *verification (ETV) (ISO 2016c):*

443 The objective of Environmental Technology Verification (ETV) is to provide
444 credible, reliable and independent verification of the performance of environ-
445 mental technologies. An environmental technology is a technology that either
446 results in an environmental added value or measures parameters that indicate an
447 environmental impact. Such technologies have an increasingly important role in
448 addressing environmental challenges and achieving sustainable development.

449 ETV contributes to protection and conservation of the environment by pro-
450 moting and facilitating market uptake of innovative environmental technologies,
451 especially those that perform better than relevant alternatives. ETV is particu-
452 larly applicable to those environmental technologies whose innovative features
453 or performance cannot be fully assessed using existing standards. Through the
454 provision of objective evidence, ETV provides an independent and impartial
455 confirmation of the performance of an environmental technology based on
456 reliable test data. ETV aims to strengthen the credibility of new, innovative
457 technologies by supporting informed decision-making among interested parties.

- 458 • *ISO 14063:2006—Environmental management: Environmental communica-*
459 *tion: Guidelines and examples (ISO 2006b):*

460 It gives guidance to an organization on general principles, policy, strategy and
461 activities relating to both internal and external environmental communication. It
462 utilizes proven and well-established approaches for communication, adapted to
463 the specific conditions that exist in environmental communication. It is applica-
464 ble to all organizations regardless of their size, type, location, structure, activ-
465 ities, products and services, and whether or not they have an environmental
466 management system in place.

467 It is not intended for use as a specification standard for certification or registra-
468 tion purposes or for the establishment of any other environmental management
469 system conformity requirements. It can be used in combination with any of the
470 ISO 14000 series of standards, or on its own.

- 471 • *ISO 14045:2012—Environmental management: Eco-efficiency assessment*
472 *of product systems: Principles, requirements and guidelines (ISO 2012b):*

473 It describes the principles, requirements and guidelines for eco-efficiency
474 assessment for product systems including: (1) the goal and scope definition
475 of the eco-efficiency assessment, (2) the environmental assessment, (3) the
476 product-system-value assessment, (4) the quantification of eco-efficiency, (5)
477 interpretation (including quality assurance), (6) reporting, and (7) critical review
478 of the eco-efficiency assessment.

479 Requirements, recommendations and guidelines for specific choices of cat-
480 egories of environmental impact and values are not included. The intended
481 application of the eco-efficiency assessment is considered during the goal and
482 scope definition phase, but the actual use of the results is outside the scope of
483 this standard.

484 (2) *Water footprints*

- 485 • *ISO 14046:2014—Environmental management: Water footprint: Principles,*
486 *requirements and guidelines (ISO 2014a):*

487 It specifies principles, requirements and guidelines related to water footprint
488 assessment of products, processes and organizations based on LCA.

489 It provides principles, requirements and guidelines for conducting and report-
490 ing a water footprint assessment as a stand-alone assessment, or as part of a
491 more comprehensive environmental assessment. Only air and soil emissions
492 that impact water quality are included in the assessment, and not all air and soil
493 emissions are included.

494 Whereas reporting is within the scope of this standard, communication of
495 water footprint results, for example in the form of labels or declarations, is
496 outside the scope of the standard.

- 497 • *ISO/TR 14073:2017—Environmental management: Water footprint: Illustrative examples on how to apply ISO 14046 (ISO 2017b):*
498

499 It provides illustrative examples of how to apply ISO 14046, in order to assess
500 the water footprint of products, processes and organizations based on life cycle
501 assessment.

502 The examples are presented to demonstrate particular aspects of the appli-
503 cation of ISO 14046 and therefore do not present all of the details of an entire
504 water footprint study report as required by ISO 14046.

505 (3) *Life cycle assessment*

- 506 • *ISO 14044:2006—Environmental management: Life cycle assessment:
507 Requirements and guidelines (ISO 2006c):*

508 It specifies requirements and provides guidelines for Life Cycle Assessment
509 (LCA) including: definition of the goal and scope of the LCA, the life cycle
510 inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase,
511 the life cycle interpretation phase, reporting and critical review of the LCA,
512 limitations of the LCA, relationship between the LCA phases, and conditions
513 for use of value choices and optional elements. It covers LCA studies and LCI
514 studies.

- 515 • *ISO/TR 14047:2012—Environmental management: Life cycle assessment:
516 Illustrative examples on how to apply ISO 14044 to impact assessment
517 situations (ISO 2012c):*

518 The purpose of this standard is to provide examples to illustrate current practice
519 of life cycle impact assessment according to ISO 14044:2006. These examples
520 are only a sample of all possible examples that could satisfy the provisions
521 of ISO 14044. They offer “a way” or “ways” rather than the “unique way”
522 of applying ISO 14044. They reflect the key elements of the life cycle impact
523 assessment (LCIA) phase of the LCA. The examples presented in this standard
524 are not exclusive and other examples exist to illustrate the methodological issues
525 described.

- 526 • *ISO/TS 14048:2002—Environmental management: Life cycle assessment:
527 Data documentation format (ISO 2002):*

528 This Technical Specification provides the requirements and a structure for a
529 data documentation format, to be used for transparent and unambiguous docu-
530 mentation and exchange of LCA and LCI data, thus permitting consistent
531 documentation of data, reporting of data collection, data calculation and data
532 quality, by specifying and structuring relevant information.

533 The data documentation format specifies requirements on division of data
534 documentation into data fields, each with an explanatory description. The
535 description of each data field is further specified by the structure of the data

documentation format. This Technical Specification is applicable to the specification and structuring of questionnaire forms and information systems. However, it can also be applied to other aspects of the management of environmental data. This Technical Specification does not include requirements on completeness of data documentation. The data documentation format is independent of any software or database platform for implementation.

This Technical Specification does not require any specific sequential, graphic or procedural solutions for the presentation or treatment of data, nor does it describe specific modelling methodologies for LCI and LCA data.

- *ISO/TR 14049:2012—Environmental management: Life cycle assessment: Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis (ISO 2012d):*

It provides examples about practices in carrying out a LCI as a means of satisfying certain provisions of ISO 14044:2006. These examples are only a sample of the possible cases satisfying the provisions of ISO 14044. They offer “a way” or “ways” rather than the “unique way” for the application of ISO 14044. These examples reflect only portions of a complete LCI study.

- *ISO/TS 14072:2014—Environmental management: Life cycle assessment: Requirements and guidelines for organizational life cycle assessment (ISO 2014b):*

It provides additional requirements and guidelines for an effective application of ISO 14040 and ISO 14044 to organizations. It provides guidelines about: (1) the application of LCA principles and methodology to organizations, (2) the benefits that LCA can bring to organizations by using LCA methodology at organizational level, (3) the system boundary, (4) specific considerations when dealing with LCI, LCIA, and interpretation, and (5) the limitations regarding reporting, environmental declarations, and comparative assertions.

This standard applies to any organization that has interest in applying LCA. It specifically covers the goals of ISO 14040 and ISO 14044.

2.4.2.4 Greenhouse Gases

This group of standards cover the following aspects: ‘Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals’, ‘Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements’, ‘Carbon footprint of products: Requirements and guidelines for quantification and communication’, and ‘Quantification and reporting of greenhouse gas emissions for organizations: Guidance for the application of ISO 14064-1’, with further information presented below.

- 574 • *ISO 14064-1:2006—Greenhouse gases: Part 1: Specification with guidance at the*
 575 *organization level for quantification and reporting of greenhouse gas emissions*
 576 *and removals (ISO 2006e):*

577 It specifies principles and requirements at the organization level for quantification and
 578 reporting of GreenHouse Gas (GHG) emissions and removals. It includes require-
 579 ments for the design, development, management, reporting and verification of an
 580 organization’s GHG inventory.

- 581 • *ISO 14064-2:2006 Greenhouse gases: Part 2: Specification with guidance at*
 582 *the project level for quantification, monitoring and reporting of greenhouse gas*
 583 *emission reductions or removal enhancements (ISO 2006e):*

584 It specifies principles and requirements and provides guidance at the project level for
 585 quantification, monitoring and reporting of activities intended to cause GHG emission
 586 reductions or removal enhancements. It includes requirements for planning a GHG
 587 project, identifying and selecting GHG sources, sinks and reservoirs relevant to the
 588 project and baseline scenario, monitoring, quantifying, documenting and reporting
 589 GHG project performance and managing data quality.

- 590 • *ISO/TS 14067:2013—Greenhouse gases: Carbon footprint of products: Require-*
 591 *ments and guidelines for quantification and communication (ISO 2013b):*

592 It specifies principles, requirements and guidelines for the quantification and com-
 593 munication of the Carbon FootPrint of a product (CFP), based on International Stan-
 594 dards on life cycle assessment (ISO 14040 and ISO 14044) for quantification and on
 595 environmental labels and declarations (ISO 14020, ISO 14024 and ISO 14025) for
 596 communication.

597 This standard is applicable to CFP studies and different options for CFP
 598 communication based on the results of such studies.

599 This standard also provides for the development of CFP-Product Category Rules
 600 (CFP-PCR), or the adoption of PCR that have been developed in accordance with ISO
 601 14025 and that are consistent with ISO/TS 14067:2013. This standard only addresses
 602 one impact category: climate change.

- 603 • *ISO/TR 14069:2013—Greenhouse gases: Quantification and reporting of green-*
 604 *house gas emissions for organizations: Guidance for the application of ISO*
 605 *14064-1 (ISO 2013c):*

606 It describes the principles, concepts and methods relating to the quantification and
 607 reporting of direct and indirect GHG emissions for an organization. It provides guid-
 608 ance for the application of ISO 14064-1 to greenhouse gas inventories at the organi-
 609 zation level, for the quantification and reporting of direct emissions, energy indirect
 610 emissions and other indirect emissions.

611 It describes for all type of organizations, including local authorities, the steps
 612 for: (1) establishing organizational boundaries, in accordance with either a control
 613 approach (financial or operational) or an equity share approach, (2) establishing
 614 operational boundaries, by identifying direct emissions and energy indirect emissions

615 to be quantified and reported, as well as any other indirect emissions the organization
616 chooses to quantify and report; for each category of emission, guidance is provided
617 on specific boundaries and methodologies for the quantification of GHG emissions
618 and removals, (3) GHG reporting: guidance is provided to promote transparency
619 regarding the boundaries, the methodologies used for the quantification of direct and
620 indirect GHG emissions and removals, and the uncertainty of the results.

621 **2.5 Application of Directives, Regulations and Standards** 622 **in Sustainable Product Design and Manufacture**

623 Regulations, directives and standards can be applied in design and manufacturing
624 processes to comply with environmental legislation and/or reduce the environmental
625 and social impact of products. However, all these tools have different purposes and
626 are applied differently during the design and manufacturing process.

627 Regulations and directives usually prescribe design recommendations which have
628 to be taken into account during the design process. For example, the Energy-related
629 Products (ErP) Directive 2009/125/EC (European Commission 2009a, b) provide
630 general recommendations about how to improve the energy efficiency of energy-
631 using products throughout their life cycle. These design guidelines/recommendations
632 have to be included at the beginning of the design process, during the ‘product design
633 specifications’ stage, so these design recommendations can be considered during the
634 definition of the initial concept of the product. Another example is the Restriction of
635 Hazardous Substances (RoHS) directive which ban the utilisation of specific amount
636 of certain hazardous substances in products. This recommendation also has to be
637 taken into account during the material selection stage of the design process.

638 The application of standards is not compulsory during the design and manufac-
639 turing processes. However, some tests and certifications oblige to follow certain
640 standards to be valid and be recognised in industry. For example, standards pro-
641 vide the protocols and procedures used to carry out the tests which are necessary to
642 improve the reliability of the product, to obtain a certification (e.g. CE mark, IP test),
643 or to conduct a performance analysis/tests (e.g. energy consumption analysis).

644 **2.6 Concluding Remarks**

645 After giving brief definitions of the three terms ‘directives’, ‘regulations’ and ‘stan-
646 dards’ which are specially addressed in this chapter, the authors reviewed nine direc-
647 tives, two regulations and 26 standards related to the design and manufacture of
648 sustainable products.

649 With the increasing demands for sustainable products, the product designers and
650 manufacturers must comply with the sustainability related directives, regulation and

standards. However, it is a challenge for the designers and manufacturers to find the related directives, regulations and standards for their particular product development tasks. The review presented in this chapter provides support for the product designers and manufacturers to overcome the challenge.

In addition, at the end of this chapter, it is presented how to apply the directives, regulations and standards in sustainable product design and manufacture. This is valuable guidelines for product designers and manufactures in their sustainable product development practice. As examples of successful applications, the guidelines have been applied in eco-lighting products (Casamayor and Su 2013) and implemented in the myEcoCost project supported by the European Commission FP7 programme (Geibler et al. 2015).

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Author Queries

Chapter 2

Query Refs.	Details Required	Author's response
AQ1	Please confirm if the inserted "Abstract" is correct. Amend if necessary.	
AQ2	The reference citation 'European Commission (2009a), (2012a)' have been changed to 'European Commission (2009a, b), (2012a, b)' to match the referene list. Please check and amend if necessary.	
AQ3	Please check and confirm the edit made in the Table 2.2.	
AQ4	References "European Commission (2005), IEC (2015), ISO (2006c)" are given in the list but not cited in the text. Please cite them in text or delete them from the list.	