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EU Ecolabel criteria for Graphic Paper, Tissue Paper and Tissue Products.

Final Technical Report

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Abstract

This Technical Report presents the EU Ecolabel criteria for Graphic Paper, Tissue Paper and Tissue Products, as published in Commission Decision (EU) 2019/70, and provides supporting rationale and background research for each criterion.

The final criteria are the result of a broad consultation exercise including stakeholder interaction at two Ad-Hoc Working Group meetings (one in Seville and one in Brussels), discussions with specialised stakeholders in particular sub-groups (for emissions, for energy and for hazardous substances) as well as dialogue with Commission colleagues and EU Ecolabel Board members.

The four main criteria are split into:

- Emissions to air and water (CO_2, NO_x and S emitted to air and COD, P and AOX emitted to water).
- Energy consumption (fuel and electricity).
- Fibre sourcing (minimum sustainable virgin and/or recycled fibre content).
- Hazardous substances (horizontal restrictions for SVHCs and substances with certain CLP classifications plus specific restrictions for chlorine, APEOs, surfactants, biocidal products, azo dyes, metal-complex dye stuffs and pigments and lotions in defined circumstances).

Decision (EU) 2019/70 effectively combines the revision of previous criteria from three different Commission Decisions. The revision of criteria in Decision 2011/332/EU for Copying and Graphic Paper and Decision 2012/448/EU for Newsprint Paper were merged under Annex I of the new Decision while the revision of criteria in Decision 2009/568/EC for Tissue Paper is contained in Annex II of Decision (EU) 2019/70.

Some of the main changes that have occurred to the criteria content are as follows:

- Emission values for P, COD, AOX, S and NO_x have been updated based predominantly on data available following the BREF exercise for pulp, paper and board production.
- Emission values for CO_2 have been updated based on data provided by stakeholders and on approaches taken by the Nordic Ecolabel scheme.
- Specific energy consumption values have been updated based on data available in the literature and data provided by stakeholders. A new threshold has also been set for higher performance "*structured*" tissue paper products.
- There is no longer any distinction between recycled fibres and sustainable virgin fibres for EU Ecolabel criteria. This approach is now better aligned with the "*FSC mix*" and "*PEFC certified*" approaches. The minimum "*sustainable fibre*" content (i.e. sum of sustainable virgin and any recycled fibre) has increased from 50% to 70%.
- Fragrances are now banned in Tissue Paper products. The horizontal SVHC and CLP restrictions now apply to Tissue Paper and Tissue Products as well.

The criteria development process is reflected in the evolution of earlier draft versions of the Technical Report, which are all publically available at the following webpage: http://susproc.jrc.ec.europa.eu/Paper_products/

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1. Introduction

1.1. Brief background to the EU Ecolabel

The EU Ecolabel is a voluntary labelling scheme created in 1992 and a key policy instrument within the European Commission's Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan (see COM(2008) 397) and the Roadmap for a Resource-Efficient Europe (see COM/2011/0571). The Roadmap seeks to move the economy of Europe onto a more resource efficient path by 2020 in order to become more competitive and to create growth and employment.

The EU Ecolabel promotes the production and consumption of products with a reduced environmental impact along the life cycle and is aimed at the best environmentally performing products in the market. However, it is appreciated that this may be difficult to judge accurately when multiple criteria are set on a pass-fail basis as is generally the case with the EU Ecolabel approach.

The entire life cycle of the product is considered, from the extraction of raw material through to production, packaging, distribution, use and disposal. The EU Ecolabel may define criteria that target environmental impacts from any of these life cycle phases, with the aim being to preferentially target those areas of greatest impact. The criteria development process involves technical experts, non-governmental organisations (NGOs), Member State representatives and industry stakeholders. Because the life cycle of each product and service is different, the criteria are tailored to address the unique characteristics of each product or service type. They are revised typically every four years to reflect upon technical innovation such as alternative materials or production processes, reductions in emissions and market developments.

The EU Ecolabel also has links with other policy instruments, such as Green Public Procurement (GPP, see COM(2008) 400), the Eco-Management and Audit Scheme (EMAS) (see Regulation (EC) No 1221/2009 and Regulation (EU) No 2018/2026) and the Ecodesign Directive (see Directive 2009/125/EC).

The development and revision processes of EU Ecolabel criteria are carried out in accordance with the EU Ecolabel Regulation (EC) No 66/2010. An important part of the process for developing or revising EU Ecolabel criteria is the involvement of stakeholders through publication of draft technical reports and subsequent consultation exercises. The main consultation exercise is AHWG meetings, supported by other stakeholder interactions such as conference calls, email exchanges, site visits and forum discussions and written comments submitted via an online platform.

Articles 7(2) and 11(2) of Regulation (EC) No 66/2010 make provisions to encourage alignment between criteria for the EU Ecolabel and other suitable ISO 14024 Type I ecolabels for similar products. However, care must be taken to ensure that any such alignments are based on scientifically sound rationale, do not create geographical distortions for potential applicants and ultimately, that the proposed criteria are acceptable to the majority of EU Ecolabelling Board (EUEB) members who must vote on the final proposed criteria prior to its adoption.

Other ecolabel schemes of particular relevance to Graphic and Tissue Paper, some of which have been recently updated, were identified as the following:

- Nordic Ecolabel[1] for Copy and Printing Paper (NO, SE, FI, DK, latest version 4.3, June 2011);
- Nordic Ecolabel for Tissue Paper (NO, SE, FI, DK, latest version 5.7, Oct. 2011);
- Blue Angel DE-UZ 5 for Sanitary Paper (DE, latest version 2, July 2014);

[1] Note that the Nordic Ecolabel criteria for both Copy and Printing Paper and Tissue Paper also refer to two separate common sets of criteria referred to as "Basic Module" (latest version 2.4, June 2011) and "Chemical Module" (latest version 2.5, June 2011).

- Blue Angel DE-UZ 4a for Recycled Paper (DE, latest version 1, January 2018);
- Blue Angel DE-UZ 72 for Printing and Publication Papers (DE, latest version 5, July 2014);
- Green Seal standard (GS1) for Sanitary Paper Products (US, latest version 6.2, January 2019);
- Green Seal Standard (GS8) for Printing and Writing Paper (US, latest version 6.1, July 2013), and
- Green Seal Standard (GS10) for Coated Printing Paper (US, latest version 2.1, July 2013).

1.2. The criteria revision process

The results of the REFIT exercise for the EU Ecolabel show that the uptake of the schemes could be better and more efficient if applying a more focused approach to maximize impacts on the ground (see COM(2017) 355).

The typical standard approach that is taken for the revision of EU Ecolabel criteria is illustrated in Figure 1.

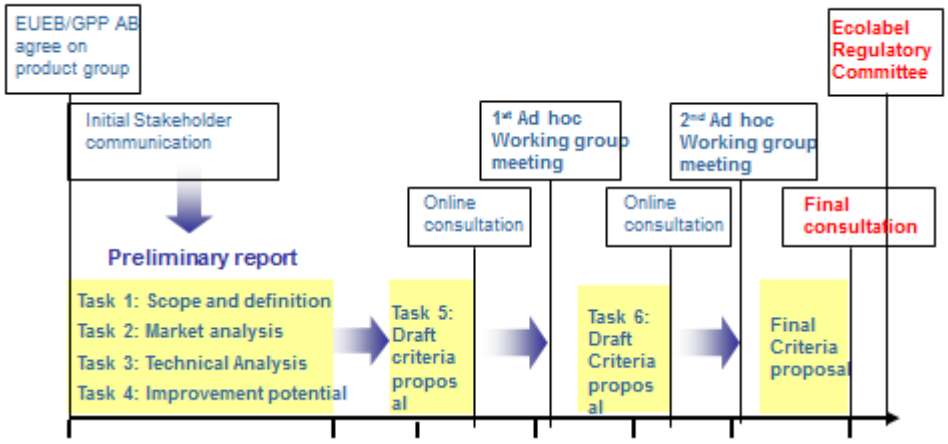


Figure 1. Overview of the typical EU Ecolabel revision process

A draft Preliminary Report (PR) was published in parallel with Technical Report v.1 (both May 2016) ahead of the 1st AHWG meeting held in June 2016 in Seville. The PR examined the current legal, political and market context of copying and graphic paper (CGP), newsprint paper (NP) and tissue paper (TP). The technical aspects of pulp and paper production were presented and considered from an LCA perspective with a view to identifying the main hot-spots.

After the setting up of specialised sub-groups for emissions, for energy and for hazardous substances and consultation therein, a second version of the EU Ecolabel criteria was presented in a 2nd AHWG meeting for Graphic Paper in October 2017 in Brussels and for Tissue Paper in November 2017 in Brussels.

A 3rd version of the Technical Report was prepared in January 2018 for consultation by EUEB members for discussion at the February 2018 EUEB. Following EUEB feedback and some final revisions, the criteria passed through inter-service consultation and were positively voted by the EUEB in June 2018 and officially adopted in Commission Decision (EU) 2019/70 and this final version of the Technical Report provides the rationale and background research for the adopted criteria.

2. Preliminary Report summary

The full preliminary report can be found at the project website.

2.1 Short overview of pulp and papermaking technologies

Pulp for papermaking may be produced from virgin wood by chemical or mechanical processes or a combination of both. Pulp may also be produced from recycled or waste material by mechanical means (re-pulping) with or without deinking treatment. Paper is produced by the conversion of pulp slurry into solid paper sheets or boards.

The choice of method will influence the options for intended use and quality of the final product (Table 1). The main challenge related to pulp from recovered paper is de-inking and the removal of contaminants.

Table 1. Summary of different pulping processes and typical final product destination

Pulping process	Fibre separation mechanism	Yield	Pulp properties	Typical products
Mechanical	Mechanical energy	High (85-95%) lignin preserved	Short, weak, unstable, high opacity fibres, good print quality	Newsprint, magazines, books, container board
Chemical	Chemical and thermal	Lower (45-50% for bleachable/bleached pulp. 70% for brown paper)	Long, strong, stable fibres	Kraft: bags, wrapping, linerboard, newsprint, graphic, writing paper, Sulfite: fine paper, tissue, glassing, newsprint
Semi chemical	Combination of chemical and mechanical	Intermediate (55-85%)	"Intermediate" pulp properties	Corrugated board, food packaging, newsprints, magazines
Recycled (RCF fibre)	Mainly mechanical with some heat and chemicals	Depends on waste paper source. Up to 95% for waste packaging, and 60% for waste hygienic products	Mixture of fibre grades, properties depend on waste paper source	Newsprint, magazines, packaging, tissue and writing paper.

To a certain extent for a given pulping technology, the type of wood used may influence the yield, the process setup and the emission levels. Wood from Eucalyptus, due its tendency to have a higher Phosphorus (P) content than other wood, might generate higher P emissions. With Elemental Chlorine Free (ECF) bleaching, hardwood typically requires fewer chemicals than softwood, which can reduce the number of bleaching stages needed.

Bleaching of pulp is carried out to improve its optical properties, which will also affect the brightness of the eventual paper product. The bleaching techniques used for mechanical pulps and chemical pulps are conceptually different.

Chemical pulps are bleached under conditions that are strong enough to also remove lignin (sometimes referred to as delignification). The absence of lignin is linked to the industry term "*wood-free paper*", which means the paper is made solely from pulp with no lignin content (this term is used despite the fact that the chemical pulp itself was made from wood). Chemical pulp bleaching is a multistage process normally composed of four or more steps, depending on final product requirements. Traditionally chlorine gas was used as the main bleaching agent. However, as this was associated with high AOX emissions, chlorine gas has been replaced by chlorine dioxide in ECF processes and chlorine dioxide by hydrogen peroxide and other

chemicals in Total Chlorine Free (TCF) processes. According to 2012 data, the market for bleaching of chemical pulp is dominated by ECF bleaching (93.9%) whereas TCF accounted for just 4.7%.

Mechanical pulp bleaching does not achieve lignin removal and is often referred to as "*brightening*" instead of bleaching. The main objective is to remove the colour-causing groups known as chromophores (conjugated groups responsible for absorbing visible light). The most commonly used bleaching agent for mechanical pulp is alkaline hydrogen peroxide, followed by sodium dithionite. However, the brightness gained is temporary and paper products suffer from "*yellowing*" or brightness reversion via gradual oxidation of lignin after exposure to air and UV radiation.

For recycled pulp (herein referred to as RCF pulp) brightening chemicals like alkaline hydrogen peroxide (P) are normally used and chemicals such as NaOH might be introduced into the re-pulping process.

In terms of plant set-up, a pulp mill may be dedicated to the production of market pulp for sale to paper producers (non-integrated production) or for the production of paper on the same site (integrated production). It is also possible for integrated mills to produce an excess of pulp for sale as market pulp and/or purchase market pulp in order to optimise the fibre composition (and thus technical properties) of the paper product. In non-integrated market pulp production, the pulp slurry (around 99% water) must be dewatered and dried to a moisture content of around 10% to ensure efficient transport of solid bales to the paper mill. In integrated mills, the slurry can be directly transferred to the paper machine. Consequently, significant energy savings are possible in the integrated process (around 1000 kWh of heat energy per tonne of air dried pulp).

In both integrated and non-integrated processes, pulp is gradually dried using heat (normally from fuel combustion) into a wet web and the web is formed into a continuous sheet by rolling through a series of rollers. The sheet will then be calendared and reeled to ensure that the paper meets certain dimensional tolerances. Super-calendaring can be carried out to meet even stricter dimensional tolerances. Process chemicals (to optimise paper mill performance) and functional chemicals (to impart specific technical properties to the final paper product) are added at certain stages of the paper machine.

The pulping process is generally independent of the final paper product (i.e. graphic paper or tissue paper). However, due to the different properties of the final product, there are some important differences in the paper machine when producing graphic paper or tissue paper. The main difference is how the paper is dried, especially with the use of what is known as a Yankee cylinder for tissue paper production, which ensures an extremely rapid drying, which in turn requires higher temperatures for the shorter contact time.

2.2. Life Cycle Assessment (LCA) of pulp and paper production

The LCA analysis in the PR was based on the ongoing PEF pilot project for intermediate pulp and paper products. The PEF screening study for intermediate paper products (EC, 2015) reports results for a total of 17 different impact categories which are summarised in Figure 2 below, splitting impact categories in terms of perceived quality and then in terms of magnitude of impact.

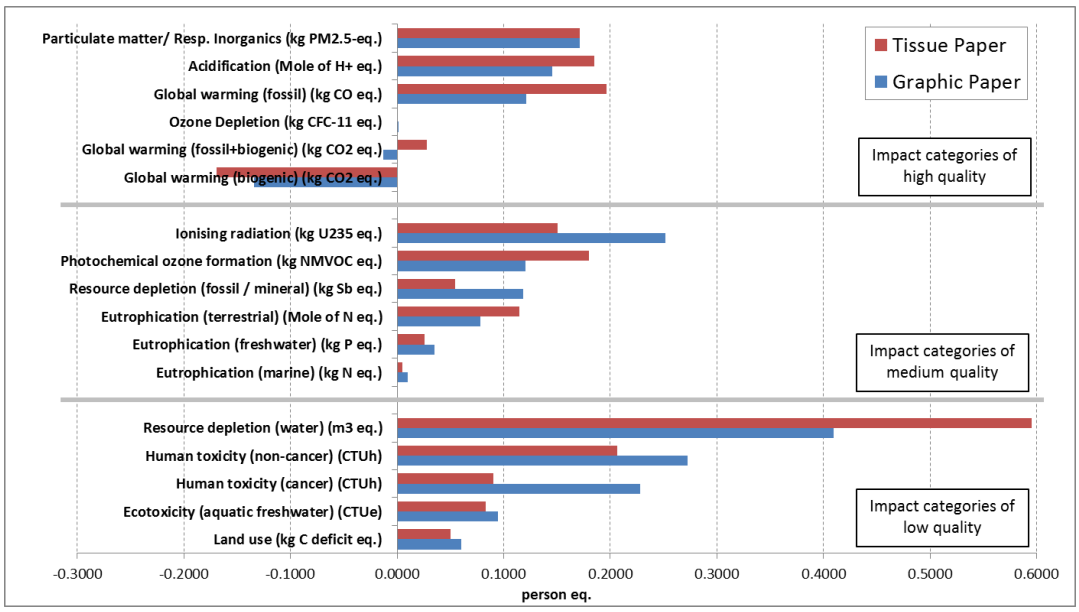


Figure 2. Identification of most relevant impact categories for a representative graphic paper intermediate product (EC, 2015).

Considering impact categories of high quality, all categories were of a similar degree of importance between tissue and graphic paper. Ozone depletion potential was negligible and the fossil global warming impacts are largely cancelled out by biogenic global warming impacts. Both acidification potential (AP) and particulate matter/respiratory organics (PM/RI) were the dominant adverse environmental impacts associated with high quality indicators.

With impact categories of medium quality, ionising radiation and photochemical ozone formation were most important. Fossil and mineral resource depletion and terrestrial eutrophication were also significant, but to a lesser degree. Freshwater and marine eutrophication impacts were found to be much less important, arguably reflecting the substantial progress made in curbing emissions of N and P in final effluents from wastewater treatment plants.

Impact categories of low quality are dominated by water resource consumption but this impact category suffers from the limitations described by Berger and Finkbeiner (2013). Human toxicity (cancer and non-cancer) is also significant in terms of scale when compared to higher quality impact categories and the gravity of their impact on human life adds weight to its general importance.

2.2.1. LCA hotspots

The main LCA hotspots were identified in the PEF screening report (EC, 2015) by defining an average European graphic paper product (the same was also done for tissue paper) and splitting the production process into different steps categories. The main components of the representative graphic paper product were: 30.5% Kraft pulp (19.6% non-integrated, 10.9% integrated); 25.3% filler; 18.7% mechanical pulp (13.3% thermomechanical pulp and 5.4% stone groundwood pulp); 17.9% deinked pulp and 5.8% moisture.

Although generally insignificant, the study did not consider the use phase of the product since they were considered as intermediate products.

Table 2. Relative contributions of defined processes for Graphic Paper for impact category.

	Transport	Wood from forest	Paper for recycling	Credit EoL saved	Pulp - waste	Pulp - energy	Paper - energy	Pulp – water withdrawal	Paper – water withdrawal	Pulp – chemicals and additives	Paper – chemicals and additives	Pulping - process	Paper - process	Paper mill infrastructure	Highlighted contribution
Global warming (fossil) (kg CO2 eq.)	4%	2%	1%	-1%	0%	7%	61%	0%	0%	9%	9%	6%	0%	2%	**85%**
Global warming (biogenic) (kg CO2 eq.)	0%	144%	0%	13%	-4%	12%	-10%	0%	0%	0%	1%	-55%	0%	0%	**97%**
Ozone Depletion (kg CFC-11 eq.)	3%	5%	5%	0%	0%	20%	32%	0%	0%	10%	21%	1%	0%	4%	**83%**
Human toxicity (cancer) (CTUh)	2%	6%	3%	0%	0%	18%	5%	0%	0%	31%	16%	2%	0%	18%	**83%**
Human toxicity (non-cancer) (CTUh)	7%	3%	2%	-1%	0%	15%	19%	0%	0%	17%	18%	6%	0%	13%	**82%**
Acidification (Mole of H+ eq.)	5%	2%	1%	-1%	0%	7%	46%	0%	0%	7%	11%	20%	0%	2%	**84%**
PM/ Resp. Inorganics (kg PM2.5-eq.)	2%	3%	1%	-3%	0%	9%	50%	0%	0%	6%	8%	18%	0%	5%	**85%**
Ecotoxicity (aquatic freshwater) (CTUe)	1%	2%	2%	0%	0%	17%	6%	0%	0%	11%	19%	28%	0%	13%	**88%**
Ionising radiation (kg U^{235} eq.)	0%	2%	1%	0%	0%	55%	24%	0%	0%	8%	8%	0%	0%	2%	**95%**
Photochem. O_3 formation (kg NMVOC eq)	10%	7%	3%	-2%	0%	5%	35%	0%	0%	5%	10%	25%	0%	2%	**80%**
Eutrophication (terrestrial) (Mole of N eq.)	11%	3%	3%	-2%	0%	5%	33%	0%	0%	5%	10%	28%	0%	2%	**82%**
Eutrophication (freshwater) (kg P eq.)	1%	1%	1%	-4%	2%	19%	4%	0%	0%	8%	9%	31%	18%	11%	**88%**
Eutrophication (marine) (kg N eq.)	4%	4%	0%	-4%	1%	11%	10%	0%	0%	12%	50%	9%	0%	2%	**83%**
Land use (kg C deficit eq.)	1%	76%	1%	0%	0%	3%	7%	0%	0%	1%	5%	1%	0%	5%	**83%**
Resource depl. (water) (m3 eq.)	0%	0%	0%	0%	0%	2%	11%	51%	29%	4%	2%	0%	0%	0%	**80%**
Resource depl. (fossil / mineral) (kg Sb eq)	2%	8%	3%	0%	0%	3%	5%	0%	0%	19%	25%	3%	0%	33%	**85%**

The data in Table 2 show that the impact of recycled content is generally insignificant, even when the representative product had significant recycled fibre content (179kg/t paper). On the other hand, the acquisition of wood was the dominant impact on biogenic carbon emissions and land use impacts.

Transport was relatively unimportant in all impact categories compared to other processes and materials. The most relevant impacts related to transport were terrestrial eutrophication and photochemical ozone formation.

Impacts due to the pulping and papermaking processes have been split into energy, water withdrawal, chemicals/additives and process. When combined into pulping alone or papermaking alone, it is clear that one or both of these processes dominate every other LCA impact category apart from biogenic carbon and land use.

The largest normalised impact category according to Figure 2 (water resource depletion) was dominated by pulping (51%), although this was considered as a low quality indicator. The three most important high quality indicators listed in Figure 2 (AP, GWP (fossil) and PM/RI), were dominated by energy use in the paper machine (46%, 61% and 50% respectively). The links between the LCA and non-LCA impacts and the revised EU Ecolabel criteria are presented in Table 3.

Table 3. Link between the hotspots identified (LCA and non-LCA impacts) and the revised EU Ecolabel criteria

Identified hotspots (LCA impacts)	Revised or new EU Ecolabel criteria	Comments on the related criteria
Acidification	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of S and NOx to air and arising from the pulping and papermaking processes. It ensures a reduction in energy use, which is the main source of NOx and S emissions in the pulping and papermaking processes.
PM / Respiratory Inorganics	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of NOx to air, which plays an important role in the formation of photochemical smog. It ensures a reduction in energy use, a major source of potential emissions of PM in the pulping and papermaking processes.
Climate change (fossil/biogenic)	Criterion 2 – Energy use Criterion 3 – Fibres	It ensures a reduction in energy use, which is the main source of CO2 emissions in the pulping and papermaking processes. Requires the use of recycled fibres and/or sustainable virgin fibres, thereby reducing unsustainable deforestation and ensuring that forests can continue to act as carbon sinks.
Photochemical ozone formation	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of NOx to air, which plays an important role in the formation of photochemical smog. It ensures a reduction in energy use, which is linked to direct (fuel) and indirect (electricity) NOx and VOC emissions.
Human toxicity (non-cancer)	Criterion 2 – Energy use Criterion 4 – Restricted Hazardous Substances	It ensures a reduction in energy use, which is the main source of indirect toxicity impacts in the papermaking and pulping processes. It limits the hazardous substances that can be included in paper and pulp, limiting environmental and health risks for consumers.
Human toxicity (cancer)	Criterion 2 – Energy use Criterion 4 – Restricted Hazardous Substances	It ensures a reduction in energy use, which is the main source of indirect cancer impacts in the papermaking and pulping processes. It limits the hazardous substances and mixtures that can be included in pulp, limiting environmental and health risks for consumers.
Ionising radiation	Criterion 2 – Energy use Criterion 4 – Restricted Hazardous Substances	It ensures a reduction in energy use, which is the dominant source of ionisation impacts from the papermaking and pulping processes. It limits the hazardous substances that can be included in paper and pulp, limiting environmental and health risks for consumers.
Eutrophication (freshwater)	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of NOx to air and P to water arising from the pulping and papermaking processes. It ensures a reduction in energy use, an important source of emissions of NOx to air in the papermaking and pulping processes.
Ozone Depletion	Criterion 2 – Energy use Criterion 4 – Restricted Hazardous Substances	It ensures a reduction in energy use, which is the main source of indirect emissions in the pulping and papermaking processes. It prevents the use of free chlorine as a bleaching agent in the pulping process, a key pollutant in the ozone depletion mechanism.
Land use	Criterion 3 – Fibres	Requires the use of recycled fibres and/or sustainable virgin fibres, thereby avoiding the need to fell trees and/or reducing unsustainable deforestation and associated land use impacts. .
Resource depl. (fossil / mineral)	Criterion 3 – Fibres	Requires the use of recycled fibres and/or sustainable virgin fibres, thereby avoiding the need to fell trees and/or reducing unsustainable deforestation and associated biogenic resource depletion. .
Eutrophication (terrestrial)	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of NOx to air, which plays an important role in terrestrial eutrophication. It ensures a reduction in energy use, which is the main source of indirect NOx emissions to air in the pulping and papermaking processes.
Eutrophication (marine)	Criterion 1 – Emissions to water and air Criterion 2 – Energy use	It limits the emissions of NOx to air and P to water arising from the pulping and papermaking processes. It ensures a reduction in energy use, an important source of emissions of NOx to air in the papermaking and pulping processes.
Ecotoxicity (aquatic freshwater)	Criterion 1 – Emissions to water and air Criterion 2 – Energy use Criterion 4 – Restricted Hazardous Substances	It limits the emissions of AOX to water arising from the pulping process. It ensures a reduction in energy use, a significant source of indirect ecotoxicity impacts. It limits the hazardous substances and mixtures that can used in the production process, reducing impacts to the wider environment.

2.2.2 Best practice by main criteria areas

The main EU Ecolabel criteria set out for Tissue Paper (Decision 2009/568/EC), Copying and Graphic Paper (Decision 2011/332/EU) and Newsprint Paper (Decision 2012/448/EU) were considered against examples of best practice in the industry.

1. Fibre sourcing:

- Full or partial use of Paper for Recycling as a fibre source.
- Use of virgin wood from sustainably managed forests.

2. Energy consumption:

- Substitute coal or fuel oil for natural gas.
- Substitute natural gas for biomass or high calorific value wastes.
- Replace traditional boilers with Combined Heat and Power (CHP) units.
- Upgrade recovery boiler units to gasification with combined cycle technology.

3. Water consumption:

- Optimize the closure of water circuits.
- Minimise water consumption, use of water savings techniques.

4. Emissions to water:

- Avoid bleaching with chlorine gas.
- ECF bleaching reduces concerns about AOX emissions.
- TCF bleaching removes concerns with AOX emissions altogether (but the treatment plant should be optimised (i.e. alkaline pH activated sludge) to maximise biodegradation of EDTA).
- Optimise ECF or TCF bleaching sequences to further reduce bleaching chemical consumption.
- Optimise the dosing of N and P to mill wastewater treatment processes to avoid any unnecessary excess dosing of N and P to wastewater.
- Combine mill wastewater with municipal sewage where possible improvements to the C:N:P ratios can be achieved without dosing N or P at all.

5. Emissions to air:

- Reduce fuel consumption (direct emissions).
- Avoid or reduce use of fuels with sulphur content.
- Introduce flue gas desulphurisation equipment where necesssary (e.g. Kraft mills and any mill burning coal or S rich fuels).
- Modernise recovery boilers, use low-NOx burners, replace simple combustion units with gasification-combustion units and install combined cycle units.

6. Solid waste:

- Implementation of an integrated waste management plan, minimise waste generation and maximise recycling and waste recovery.

As a caveat, it is highly unlikely that any single plant would be able to embrace all of these best practices and it is necessary to account for the inherent differences in the technologies used for the production of different types of pulp (e.g. mechanical, chemical and recycled) and paper (e.g. graphic and tissue).

3. Product group names, definitions and scopes

Graphic Paper
Article 1 The product group 'graphic paper' shall comprise sheets or reels of not converted, unprinted blank paper or board, whether plain or coloured, made from pulp and fit to be used for writing, printing or conversion purposes. ***The product group shall not include:*** *(a) packaging;* *(b) thermally sensitive paper;* *(c) photographic or carbonless paper;* *(d) fragranced paper;* *(e) paper falling within the product group 'tissue paper and tissue products' as defined in Article 2.*
Tissue Paper and Tissue Products'
Article 2 The product group 'tissue paper and tissue products' shall comprise the following: (1) sheets or reels of not converted tissue paper for conversion into products falling within point (2); (2) tissue products fit for use for personal hygiene, absorption of liquids or the cleaning of surfaces, or for a combination of those purposes; including but not limited to tissue products of the following kinds: handkerchiefs, toilet tissues, facial tissues, kitchen or household towels, hand towels, table napkins, mats and industrial wipes. ***The product group shall not include:*** *(a) products falling within the product group 'absorbent hygiene products' as defined in Commission Decision 2014/763/EU;*[2] *(b) products containing cleaning agents designed for the cleaning of surfaces;* *(c) tissue products laminated with materials other than tissue paper;* *(d) cosmetic products within the meaning of Regulation (EC) No 1223/2009 of the European Parliament and of the Council3, including wet wipes;* *(e) fragranced paper;* *(f) products falling within the product group 'graphic paper' as defined in Article 1 or products falling within the product group 'printed paper' as defined in Commission Decision 2012/481/EU4.*
Article 3 **For the purposes of this Decision, the following definitions shall apply:** (1) 'pulp' means fibrous material in papermaking produced in a pulp mill either mechanically or chemically from fibrous cellulose raw material (wood being the most common); (2) 'packaging' means all products made of any material of any nature to be used for the containment, protection, handling, delivery or presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer; (3) 'tissue paper' means lightweight paper made of pulp that may be dry or wet creped or non-creped; (4) 'tissue products' mean converted products made of tissue paper in one or several plies, folded or unfolded, embossed or unembossed, with or without lamination, printed or not printed and possibly finished by post-treatment.

[2] Commission Decision 2014/763/EU of 24 October 2014 establishing the ecological criteria for the award of the EU Ecolabel for absorbent hygiene products (OJ L 320, 6.11.2014, p. 46).

[3] Regulation (EC) No 1223/2009 of the European Parliament and of the Council of 30 November 2009 on cosmetic products (OJ L 342, 22.12.2009, p. 59).

[4] Commission Decision 2012/481/EU of 16 August 2012 establishing the ecological criteria for the award of the EU Ecolabel for printed paper (OJ L 223, 21.8.2012, p. 55).

3.1. Rationale for the proposed scope and definitions

As part of the REFIT conclusions about the performance of the EU Ecolabel Regulation, the bundling of products with sufficiently similar characteristics is encouraged in order to streamline the bureaucratic process and ensure that such products are always revised in parallel. Accordingly, the product groups Newsprint Paper and Copying and Graphic Paper have been merged under the single term "*Graphic Paper*". Tissue Paper has been split into two terms "*Tissue Paper*" and "*Tissue Products*" to reflect the industry practice of the B2B sale of mother reels (Tissue Paper) and the B2B or B2C sale of final products (Tissue Products). The possibility to obtain a licence for B2B sold mother reels can greatly simplify the application procedure for Competent Bodies and applicants when that mother reel is converted into a Tissue Product that aims to carry the EU Ecolabel logo.

The terms "*Graphic Paper*" and "*Tissue Paper and Tissue Product*" are standard industry nomenclature (CEPI, 2014). Both types of product are covered by Decision (EU) 2019/70 in a single Act, which is followed by two separate annexes: Annex I (Graphic Paper) and Annex (II) (Tissue Paper and Tissue Product).

The scope for the EU Ecolabel criteria for Graphic Paper extends up until the mother reel but does not cover any subsequent conversion of that reel. The EU Ecolabel for Graphic Paper can be applied to products that are used for printing or writing purposes. In cases where the reel is subject to further conversion into a product with a different functionality, the EU Ecolabel can still be carried on those final products if they fall within the scope of the Commission Decisions for Printed Paper (2012/481/EU) or Converted Paper (2014/256/EU) and comply with other applicable criteria set out therein.

The scope for Tissue Paper and Tissue Product extends to conversion operations for hazardous substance restrictions and fibre chain of custody responsibilities in cases where a Tissue Product is to be licensed. However, for other criteria, such as emissions to water and air and energy consumption, stakeholders clearly stated that it would be very difficult to allocate emissions or energy consumption to specific converted products due to the complex and variable operating conditions in converting lines. Furthermore, it was stated that the relative importance of impacts on energy consumption and emissions were minor compared to the pulp mills and paper machines.

3.1.1 Graphic paper

As indicated in the Preliminary Report, an initial stakeholder survey revealed the need to introduce only minor changes to the scope and definition of the product group.

The former scope for Copying and Graphic Paper incorporated an upper limit of 400 g/m^2 on the EU Ecolabel. Industry stakeholders requested that this limit be removed since it was arbitrary, did not match industry product categories and could only create potential obstacles for obtaining the EU Ecolabel in Converted Paper or Printed Paper products.

The upper grammage limit was subsequently removed and the scope linked to functionality only (i.e. writing or printing purposes). Technically speaking, packaging could fall within this scope (e.g. if it is to be printed on or converted into packaging). The Commission's position on this has been that the EU Ecolabel for packaging could be misleading if consumers might believe that the contents of the package also carry the EU Ecolabel. Consequently, packaging is specifically excluded from the scope for EU Ecolabel Graphic Paper and from the scope for EU Ecolabel Converted Paper.

3.1.2 Tissue paper and tissue products

An initial stakeholder survey (results published on JRC website in June 2016) indicated the need to reformulate the product group definition for Tissue Paper (only 23% of respondents considered the product group definition as appropriate). One key aspect

was the need to distinguish between Tissue Paper (i.e. mother reel) and Tissue Product (i.e. final consumer product).

According to EN ISO 12625:2011, the term "*Tissue Product*" means a final product that:

"*can be made of one or several plies, each ply being of one or several layers, prepared as sheets or rolls, folded or unfolded, embossed or unembossed, with or without lamination, printed or not printed and possibly finished by post-treatment, e.g. lotion application.*

"Tissue Products are derived from single-ply, semi-finished, wet-laid tissue-base papers that are predominantly composed of natural fibres. The origin of fibres may be virgin or recycled, or a mixture of both. A typical grammage of single-ply tissue-base papers ranges from 10 g/m^2 to 50 g/m^2.

"The properties of the tissue-base paper give to its resulting products the typical high capacity of tensile energy absorption together with a good textile-like flexibility, surface softness, comparatively low bulk density and high ability to absorb liquids. Disposable tissue products are commonly used for hygienic and industrial purposes.

"Nonwovens are not classified as tissue, even if one subgroup of the nonwovens is manufactured in a wet-laid manner according to a process similar to the tissue making process."

It was discussed whether or not coated or laminated Tissue Products should be excluded from the scope. This prompted a closer look at the meaning of these terms in EN ISO 12625-1:2011.

***"4.13 Coating** - NOTE In the tissue industry, this term is used in two different processes: at the Yankee cylinder and in the converting process.used in two different processes:*

> *Yankee coating - layer of an adhesive/release-agent composite in combination with other functional chemicals applied to the Yankee cylinder prior to the creping operation*
>
> *Coating in converting - any process to apply additives (chemicals, lotion) onto the tissue sheet during converting."*

The EN ISO 12625-1:2011 standard also states that the term "*coating*" has a different meaning for producers of printing and writing paper. In those sectors, "*coating*" means:

"- a layer of a pigment/binder composition applied to the surface of a paper or board having an impact on the surface structure, the optical appearance and the optical and printing behaviour of the coated product;

"- the process of applying a coating composition."

From the definitions above it is clear that the term coating can apply to both converted Tissue Products and unconverted Tissue Paper and so should not be excluded from the scope *per se*.

With lamination, some stakeholders understood this as being potentially interpreted as inclusive of lamination with plastic and so they requested to exclude laminated Tissue Products from the scope. According to EN ISO 12625-1:2011:

*"**4.36 Laminating** - process of joining together two or more plies of a tissue material (tissue paper web, tissue paper sheet) to form a multi-ply tissue product."*

Based on this definition, it would not be feasible to exclude laminated Tissue Products from the scope but to clarify that products laminated with materials other than tissue paper are excluded.

Absorbent hygiene products or undergarments (e.g. disposable diapers, etc.), were assumed to be specifically excluded from the scope due to a specific functionality but this exclusion has been explicitly stated in Decision (EU) 2019/70 for the avoidance of doubt. Such products can still carry the EU Ecolabel logo so long as they comply with another set of criteria provided in Commission Decision 2014/763/EU.

The explicit exclusion of products containing cleaning agents and fragrances is stated for clarity. The approach to fragrances is stricter than the previous criteria published in 2009. Tissue Products containing cosmetics to the extent that they can be considered as

Cosmetics Products as per Regulation (EC) 1223/2009 (i.e. products that act as a vehicle to transfer cosmetic substances to external parts of human bodies to clean, perfume, change appearance, correct body odours or keep them in a good condition) are also excluded.

Wet wipes are generally considered to contain cosmetic substances or mixtures and therefore act as a cosmetic product (EC, 2016). However, for the avoidance of doubt, the exclusion of wet wipes is explicitly mentioned.

3.1.3 Definitions

The following definitions, presented in alphabetical order, shall apply:

Graphic Paper
(1) 'air dry tonne' means air dry tonne (ADt) of pulp expressed as 90 % dryness; (2) 'chemical pulp' means fibrous material obtained by removal from the raw material of a considerable part of non-cellulosic compounds that can be removed by chemical treatment (cooking, delignification, bleaching); (3) 'CMP' means chemimechanical pulp; (4) 'CTMP' means chemithermomechanical pulp; (5) 'de-inked pulp' means pulp made from paper for recycling from which inks and other contaminants have been removed; (6) 'dyes' means an intensely coloured or fluorescent organic material, which imparts colour to a substrate by selective absorption. Dyes are soluble and/or go through an application process which, at least temporarily, destroys any crystal structure of the dye. Dyes are retained in the substrate by absorption, solution, and mechanical retention, or by ionic or covalent chemical bonds; (7) 'ECF pulp' means elemental chlorine-free bleached pulp; (8) 'integrated production' means pulp and paper is produced at the same site. The pulp is not dried before paper manufacture. The production of paper/board is directly connected with the production of pulp; (9) 'mechanical woodpulp paper or board' means paper or board containing mechanical woodpulp as an essential constituent of its fibre composition; (10) 'metal-based pigments and dyes' means dyes and pigments containing more than 50 % by weight of the relevant metal compound(s); (11) 'non-integrated production' means production of market pulp (for sale) in mills that do not operate paper machines, or production of paper/board using only pulp produced in other plants (market pulp); (12) 'paper machine broke' means paper materials that are discarded by the paper machine process but that have properties allowing it to be reused on site by being incorporated back into the same manufacturing process that generated it. For the purposes of this Decision, this term shall not be extended to conversion processes, which are considered as distinct processes to the paper machine; (13) 'pigments' means coloured, black, white or fluorescent particulate organic or inorganic solids which usually are insoluble in, and essentially physically and chemically unaffected by, the vehicle or substrate in which they are incorporated. They alter appearance by selective absorption and/or by scattering of light. Pigments are usually dispersed in vehicles or substrates for application, for instance in the manufacture of inks, paints, plastics or other polymeric materials. Pigments retain a crystal or particulate structure throughout the coloration process; (14) 'recycled fibres' means fibres diverted from the waste stream during a manufacturing process or generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product. These fibres can no longer be used for their intended purpose. It excludes reutilisation of materials generated in a process and capable of being reclaimed within the same process that generated them (paper machine broke — own produced or purchased); (15) 'TCF pulp' means totally chlorine-free bleached pulp; (16) 'TMP' means thermomechanical pulp.
Tissue Paper and Tissue Products
Same definition as for Graphic Paper plus: (11) 'mother reel' means a large roll of tissue paper, wound onto the winding station, covering either the full width or part of the width of the tissue paper machine;; (16) 'structured tissue paper' means paper characterised by high bulk and absorption capacity obtained with significant local areas of high and low fibre density in the form of fibre pockets in the base sheet, generated by specific processes in the tissue paper machine;;

4. EU Ecolabel criteria structure

Apart from the merging of previous Decisions for Copying and Graphic paper, Newsprint Paper and Tissue Paper into a single Commission Decision composed of two annexes for Graphic Paper and Tissue Paper and Products (Annexes I and II). The same criteria structure has generally been maintained within those Annexes. The table below shows the criteria structure set out in Commission Decision (EU) 2019/70.

Table 4. Revised structure of the criteria

Graphic paper (Annex I)	Tissue paper and tissue products (Annex II)
1. Emissions to water and air: a) COD, S, NOx and P; b) AOX; c) CO_2.	1. Emissions to water and air: a) COD, S, NOx and P; b) AOX; c) CO_2.
2. Energy use: a) Electricity; b) Fuel.	2. Energy use: a) Electricity; b) Fuel.
3. Fibres: conserving resources, sustainable forest management.	3. Fibres: conserving resources, sustainable forest management.
4. Restricted hazardous substances and mixtures; a) SVHCs; b) CLP restrictions; c) Chlorine; d)APEOs; e) surfactants; f) Biocidal products; g) Azo dyes; h) Metal-based pigments and dyes; i) Ionic impurities in dye-stuffs.	4. Restricted hazardous substances and mixtures; a) SVHCs; b) CLP restrictions; c) Chlorine; d)APEOs; e) surfactants; f) Biocidal products; g) Azo dyes; h) Metal-based pigments and dyes; i) Ionic impurities in dye-stuffs; j) Lotions.
5. Waste management.	5. Waste management.
6. Fitness for use.	6. Final product requirements: a) Dyes and optical brighteners; b) Slimicides and antimicrobial substances; c) Product safety; d) Fitness for use.
7. Information on the packaging.	7. Information appearing on the EU Ecolabel.
8. Information appearing on the EU Ecolabel.	

5. Criterion 1: Emissions to water and air

Graphic Paper/Tissue Paper and Tissue Products
As a prerequisite, the pulp and paper production site must meet all respective legal requirements of the country in which it is located. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance, supported by relevant documentation and declarations from the pulp supplier(s).*

Given that a site must operate legally under conditions specified by the competent authority and stated in the operating permit, the requirement added in the preamble provides an additional safeguard for Criterion 1 a), especially for non-EU based pulp and paper mills.

5.1. Criterion 1a) COD, S, NOx and P.

Graphic Paper
The requirement is based on information on emissions in relation to a specified reference value. The ratio between actual emissions and the reference value translates into an emissions score. The score for any individual emission parameter shall not exceed 1.3. In all cases, the total number of points ($P_{total} = P_{COD} + P_S + P_{NOx} + P_P$) shall not exceed 4.0. In case of non-integrated production, the applicant shall provide a calculation that includes pulp and paper production. For pulp and papermaking as a whole, the calculation of P_{COD} shall be made as follows (P_S, P_{NOx}, and P_P to be calculated in exactly the same way). For each pulp 'i' used, the related measured COD emissions ($COD_{pulp\ 'i}$ expressed in kg/air dry tonne — ADt) shall be weighted according to the proportion of each pulp used (pulp 'i' with respect to air dry tonne of pulp), and added together. Air dry tonne assumes 90 % dry matter content for pulp, and 95 % for paper. The weighted COD emission for the pulp is then added to the measured COD emission from the paper production to give the total COD emission, COD_{total}. The weighted COD reference value for the pulp production shall be calculated in the same way, with the sum of the weighted reference value for each pulp used and added to the reference value for the paper production to give a total COD reference value $COD_{ref,\ total}$. Table 1 contains the reference values for each pulp type used and for the paper production. Finally, the total COD emission shall be divided by the total COD reference value as follows: $$P_{COD} = \frac{COD_{total}}{COD_{ref,total}} = \frac{\Sigma_{i=1}^{n}\,[pulp,i \times (COD_{pulp,i})] + COD_{papermachine}}{\Sigma_{i=1}^{n}\,[pulp,i \times (COD_{ref\,pulp,i})] + COD_{ref\,papermachine}}$$

Table 1. Reference values for emissions from different pulp types and from paper production

Pulp grade/paper	Emissions (kg/ADt)			
	COD reference	P reference	S reference	NOx reference
Bleached chemical pulp (other than sulphite)	16.00	0.025 / 0.09(1)	0.35	1.60
Bleached chemical pulp (sulphite)	24.00	0.04	0.75	1.60
Magnefite pulp	28.00	0.056	0.75	1.60
Unbleached chemical pulp	6.50	0.016	0.35	1.60
CTMP /CMP	16.00	0.008	0.20	0.25 / 0.70(2)
TMP/groundwood pulp	3.00 / 5.40(3)	0.008	0.20	0.25
Recycled fibre pulp without de-inking	1.10	0.006	0.20	0.25
Recycled fibre pulp with de-inking	2.40	0.008	0.20	0.25
Paper mill (kg/tonne)	1.00	0.008	0.30	0.70

(1) The higher value refers to mills using eucalyptus from regions with higher levels of phosphorous (e.g. Iberian eucalyptus).

(2) NOx emission value for non-integrated CTMP mills using flash-drying of pulp with biomass-based steam.

(3) COD value for highly bleached mechanical pulp (70 – 100 % of fibre in final paper).

In cases where co-generation of heat and electricity occurs at the same plant, the emissions of S and NOx resulting from on-site electricity generation can be subtracted from the total amount. The following equation can be used to calculate the proportion of emissions resulting from electricity generation:

2 × (MWh(electricity))/[2 × MWh(electricity) + MWh(heat)]

The electricity in this calculation is the electricity produced at the co-generation plant. The heat in this calculation is the net heat delivered from the co-generation plant to the pulp/paper production.

Tissue Paper and Tissue Products

The requirement is based on information on emissions in relation to a specified reference value. The ratio between actual emissions and the reference value translates into an emissions score.

The score for any individual emission parameter shall not exceed 1.3.

In all cases, the total number of points ($P_{total} = P_{COD} + P_S + P_{NOx} + P_P$) shall not exceed 4.0.

In case of non-integrated production, the applicant shall provide a calculation that includes pulp and paper production.

For pulp and papermaking as a whole, the calculation of P_{COD} shall be made as follows (P_S, P_{NOx}, P_P to be calculated in exactly the same way).

For each pulp 'i' used, the related measured COD emissions (COD pulp 'i' expressed in kg/air dry tonne — ADt) shall be weighted according to the proportion of each pulp used (pulp 'i' with respect to air dry tonne of pulp), and added together. Air dry tonne assumes 90 % dry matter content for pulp, and 95 % for paper.

The weighted COD emission for the pulp is then added to the measured COD emission from the paper production to give the total COD emission, COD total.

The weighted COD reference value for the pulp production shall be calculated in the same way, with the sum of the weighted reference value for each pulp used and added to the reference value for the paper production to give a total COD reference value COD ref, total. Table 1 contains the reference values for each pulp type used and for the paper production.

Finally, the total COD emission shall be divided by the total COD reference value as follows:

$$P_{COD} = \frac{COD_{total}}{COD_{ref,total}} = \frac{\sum_{i=1}^{n} [pulp,i \times (COD_{pulp,i})] + COD_{papermachine}}{\sum_{i=1}^{n} [pulp,i \times (COD_{ref\,pulp,i})] + COD_{ref\,papermachine}}$$

Table 1. Reference values for emissions from different pulp types and from paper production

Pulp grade/paper	Emissions (kg/ADt)			
	COD reference	P reference	S reference	NOx reference
Bleached chemical pulp (other than sulphite)	16.00	0.025 / 0.09(1)	0.35	1.60
Bleached chemical pulp (sulphite)	24.00	0.04	0.75	1.60
Magnefite pulp	28.00	0.056	0.75	1.60
Unbleached chemical pulp	6.50	0.016	0.35	1.60
CTMP /CMP	16.00	0.008	0.20	0.25 / 0.70(2)
TMP/groundwood pulp	3.00 / 5.40 (3)	0.008	0.20	0.25
Recycled fibre pulp without de-inking	1.10	0.006	0.20	0.25
Recycled fibre pulp with de-inking	3.20	0.012	0.20	0.25
	Emissions (kg/tonne)			
Tissue paper making	1.20	0.01	0.30	0.50
Structured tissue paper making	1.20	0.01	0.30	0.70

(1) The higher value refers to mills using eucalyptus from regions with higher levels of phosphorous (e.g. Iberian eucalyptus).

(2) NOx emission value for non-integrated CTMP mills using flash-drying of pulp with biomass-based steam.

(3) COD value for highly bleached mechanical pulp (70 – 100 % of fibre in final paper).

In cases where co-generation of heat and electricity occurs at the same plant, the emissions of S and NOx resulting from on-

site electricity generation can be subtracted from the total amount. The following equation can be used to calculate the proportion of emissions resulting from electricity generation:

2 × (MWh(electricity))/[2 × MWh(electricity) + MWh(heat)]

The electricity in this calculation is the electricity produced at the co-generation plant. The heat in this calculation is the net heat delivered from the co-generation plant to the pulp/paper production.

Assessment and verification: *The applicant shall provide detailed calculations and test data showing compliance with this criterion, together with related supporting documentation that include test reports using the following continuous or periodical monitoring standard test methods (or equivalent standard methods that are accepted by the competent body as providing data of equivalent scientific quality): COD: ISO 15705 or ISO 6060; NOx: EN 14792 or ISO 11564;S (sulphur oxides): EN 14791 or EPA no 8; S(reduced sulphur): EPA no 15A,16A or 16B; S content in oil: ISO 8754; S content in coal: ISO 19579; S content in biomass: EN 15289; Total P: EN ISO 6878.*

Rapid tests can also be used to monitor emissions as long as they are checked regularly (e.g. monthly) against the relevant aforementioned standards or suitable equivalents. In the case of COD emissions, continuous monitoring based on analysis of total organic carbon (TOC) shall be accepted as long as a correlation between TOC and COD results has been established for the site in question.

The minimum measurement frequency, unless specified otherwise in the operating permit, shall be daily for COD emissions and weekly for Total P emissions. In all cases, emissions of S and NOx shall be measured on a continuous basis (for emissions from boilers with a capacity exceeding 50 MW) or a periodic basis (at least once a year for boilers and driers with a capacity less than or equal to 50 MW each).

Data shall be reported as annual averages except in cases where:

- the production campaign is for a limited time period only;

- the production plant is new or has been rebuilt, in which case the measurements shall be based on at least 45 subsequent days of stable running of the plant.

In either case, data may only be accepted if it is representative of the respective campaign and a sufficient number of measurements have been taken for each emission parameter.

The supporting documentation shall include an indication of the measurement frequency and calculation of the points for COD, Total P, S and NOx.

Emissions to air shall include all emissions of S and NOx that occur during the production of pulp and paper, including steam generated outside the production site, minus any emissions allocated to the production of electricity. Measurements shall include recovery boilers, lime kilns, steam boilers and destructor furnaces for strong smelling gases. Diffuse emissions shall also be taken into account. Reported emission values for S to air shall include both oxidised and reduced S emissions. The S emissions related to the heat energy generation from oil, coal and other external fuels with known S content may be calculated instead of measured, and shall be taken into account.

Measurements of emissions to water shall be taken on unfiltered and unsettled samples at the effluent discharge point of the mills' wastewater treatment plant. In cases where mill effluent is sent to a municipal or other third-party wastewater treatment plant, unfiltered and unsettled samples from the mill effluent sewer discharge point shall be analysed and the results multiplied by a standard removal efficiency factor for the municipal or third-party wastewater treatment plant. The removal efficiency factor shall be based on information provided by the operator of the municipal or other third-party wastewater treatment plant.

For integrated mills, due to the difficulties in getting separate emission figures for pulp and paper, if a combined figure is only available for pulp and paper production, the emission values for pulp(s) shall be set to zero and the combined emissions shall be compared against the combined reference values for the relevant pulp and paper production. The weighted content of each pulp granted a specific reference value from Table 1 shall be reflected in the equation.

5.1.1. Background to monitoring methods in pulp and paper sector

The JRC Reference Report on Monitoring (ROM) (JRC, 2017) of emissions to air and water from installations covered by the Industrial Emissions Directive 2010/75/EU (IED) addresses general principles and other relevant aspects concerning the monitoring of emissions and forms the basis for deciding on the monitoring approach, frequency of periodic testing and reporting of data.

In particular, the document covers topics which are related to the monitoring of emissions in connection with Articles 14(1)(c) and 16 of the IED. The list of standards

and methods test that addresses emission into water and air indicated in ROM document are listed below.

Table 5. Standards and methods for the measurement of emissions to water and air

Parameter	EN or ISO Standard	Monitoring frequency	Monitoring method	Measurements range and limits	Remarks
COD	ISO 15705:2002	Periodic	Oxidation with dichromate via small-scale sealed tube method followed by a) photometric detection or b) titrimetric detection	a) 6 mg/l (LoD) to 1 000 mg/l b) 15 mg/l (LoD) to 1 000 mg/l	No EN standard; several Member States use national standards for regulatory purposes e.g. NEN 6633 in NL, NF T 90 101 in FR, or DIN 38409-41 in DE)
	ISO 6060:1989	Periodic	Oxidation with dichromate via open reflux method followed by titration	30 mg/l to 700 mg/l	
Total P	EN ISO 6878:2004	Periodic	Spectrometry using ammonium molybdate after digestion with peroxodisulphate or nitric acid	0.005 mg/l to 0.8 mg/l	-
	EN ISO 15681-1:2004 EN ISO 15681-2:2004	Periodic	Flow analysis (FIA and CFA) after manual digestion with peroxodisulphate	0.1 mg/l to 10 mg/l	
	EN ISO 11885:2009	Periodic	Inductively coupled plasma optical emission spectrometry (ICP-OES)	LoQ: ~ 0.013 mg/l	
AOX	EN ISO 9562:2004	Periodic	Determination of organically bound chlorine, bromine and iodine (expressed as chloride) adsorbable on activated carbon	10 µg/l to 300 µg/l	-
Nitrogen oxides (NOx)	EN 21258:2010	Periodic	Extraction, filtration and conditioning followed by non-dispersive infrared spectrometry	Up to 1 300 mg/m3 at large combustion plants; Up to 400 mg/m3 at waste (co-)incineration plants	-
Sulphur oxides (SOx)	EN 14791:2005	Periodic	Extraction and filtration followed by absorption in aqueous H2O2 solution with subsequent sulphate determination via ion chromatography or titration	- Ion chromatography: 0.5 mg/m3 to 2000 mg/m3 (sampling duration 30 min); LoD: ≥ 0.1 mg/m3; (flow rate of 1 l/min, 100 ml of absorption solution, sampling duration of 30 min) - Titration: 5 mg/m3 to 2 000 mg/m3 (sampling duration 30 min); LoD ≥ 2.2 mg/m3; (flow rate of 1 l/min, 100 ml of absorption solution, sampling duration of 30 min)	-
Nitrogen oxides (NOx)	EN 14792:2005	Continuous	Chemiluminescence, FTIR, NDIR, NDUV, DOAS.	Lowest range: ≤ 1.6 mg/m3 (LoQ req.) to 20 mg/m3 Highest range: to 7.5 g/m3	AMS[5], SRM[6]; Certification and calibration standards: EN15267-1:2009, EN15267-2:2009, EN15267-3:2007, and EN 14181:2014.
Sulphur oxides (SOx)	EN 14791:2005	Continuous	FTIR, NDIR, NDUV, DOAS	Lowest range: ≤ 0.8 mg/m3 (LoQ req.) to 10 mg/m3 Highest range: to 8.0 g/m3	

[5] AMS - automated measuring systems (AMSs)
[6] Validation & calibration methods using Standard Reference Methods (SRMs), after the AMS has been installed.

The hierarchy of test methods stated by BAT 10 in the BAT conclusions for the production of pulp, paper and board (Decision 2014/687/EU) recognises EN and ISO standards first. In the absence of such standards, national standards can be accepted. However, in cases where a national standard is used to monitor emissions instead of an existing EN or ISO standard, it would be necessary to have third party verification confirming that the results from the national standard can be accurately correlated to results that would be obtained from analysing the same given sample under the relevant EN or ISO standard. Stakeholder feedback revealed that there are many different test methods used to monitor emissions, including rapid tests, stemming directly from national permitting requirements, in some situations development of correlation methodology was perceived as too complex. However, the JRC insisted that there must be some correlation to standard methods otherwise the data could be misleading. Following industry feedback, acceptance of equivalent test methods should be considered by Competent Body. This is also in line with guidelines that have been agreed at CB Forum level regarding test laboratories.

Chemical Oxygen Demand (COD) emissions

Following the recommendations of BAT 10 in Decision 2014/687/EU, for economic and ecological reasons there is a trend to replace COD by Total Organic Carbon (TOC). If TOC is already measured as a key process parameter, there should be no need to measure COD. However, a correlation between the two parameters should be established for the specific waste water treatment plant. A typical correlation is around 3-4 units of COD for every unit of TOC. A clause has therefore been inserted to make sure that applicants and Competent Bodies are aware that TOC data can be accepted in lieu of COD measurements.

The monitoring frequency of emissions of final effluents to water is indicated in BAT 10 of Decision 2014/687/EU as well. A monitoring frequency for mills operating less than seven days a week may be reduced to cover the days the mill is in operation or to extend the sampling period to 48 or 72 hours. Additionally, following the feedback collected, requiring daily reporting of COD for sites that use an external waste water treatment facility (indirect discharge), might cause additional administrative and cost burdens. Considering these concerns, an exemption to daily monitoring was inserted in cases where the national or regional authority has also allowed this. In these cases, monitoring frequency should match the requirements of the operating permit. In all other cases, monitoring of COD emissions shall be based on daily data.

Phosphorus (P) emissions

With P emissions, it has to be considered that there may be different types of P present in a wastewater:

- Orthophosphate (will contribute to colour development and be detected).
- Polyphosphate (may or may not contribute to colour development and thus be detected).
- Organophosphate (will not contribute to colour development and will not be detected).

All standard methods for measuring P in wastewater have options for different sample preparation techniques that can convert polyphosphate and organophosphate into orthophosphate. For clarity, the revised criteria now refer to Total P, which means that all three forms of phosphate should be counted. A minimum weekly measurement frequency should also be respected. This has now been stated in the criteria and also reflects the approach taken in the BAT 10 of Decision 2014/687/EU. Although weekly samples are less challenging than daily samples, the same exemption clause for COD emissions also applies to P emissions (i.e. if the operating permit allows less frequent monitoring due to site-specific circumstances).

Sulphur (S) and Nitrogen oxide (NOx) emissions

With respect to emissions of S and NO_x, the BAT 9 of Decision 2014/687/EU states that measurements should be continuous in certain situations (i.e. recovery boiler) and periodic or continuous in others (e.g. lime kiln or dedicated TRS burner). Thus it is difficult to simply specify any defined measurement frequency in EU Ecolabel criteria, which will also account for different pulp technologies and paper mills.

Continuous measurement techniques have an advantage over periodic measurement techniques as they provide a larger amount of data that can facilitate statistical analysis and can highlight periods of different operating conditions. According to the IED (2010/75/EU), reporting to competent authorities should be carried out yearly.

The majority of combustion plants used by the pulp and paper industry fall within the scope of the Medium Combustion Plant (MCP) Directive (EU) 2015/2193. In this sense, MCPs are defined as plants having a rated thermal input equal to or greater than 1 MW and less than 50 MW, irrespective of the type of fuel they use. Following the prescription of Annex III, Part 1(1), periodic measurements shall be required at least:

"— every three years for medium combustion plants with a rated thermal input equal to or greater than 1 MW and less than or equal to 20 MW,

— every year for medium combustion plants with a rated thermal input greater than 20 MW In the case of continuous measurements, compliance with the emission limit values referred to in Article 6 shall be assessed as set out in point 1 of Part 4 of Annex V to Directive 2010/75/EU."

In part 3 of Annex V to the IED (2010/75/EU), technical provisions relating to combustion plant emission monitoring are set out for large combustion plants. Accordingly, the concentrations of SO_2 and NO_x in waste gases from each combustion plant with a total rated thermal input of 100 MW or more shall be measured continuously. The competent authority may decide not to require the continuous in the following cases:

"(a) for combustion plants with a life span of less than 10 000 operational hours;

(b) for SO_2 and dust from combustion plants firing natural gas;

(c) for SO_2 from combustion plants firing oil with known sulphur content in cases where there is no waste gas desulphurisation equipment;

(d) for SO_2 from combustion plants firing biomass if the operator can prove that the SO_2 emissions can under no circumstances be higher than the prescribed emission limit values.

Where continuous measurements are not required, measurements of SO_2 and NO_x, shall be required at least once every 6 months."

The standard method for analysis of S in coal has been updated to ISO 19579 since ISO 351 has now been withdrawn and now reference is made to analysing S in biomass as well. When calculating S emissions simply by analysing the S content of the fuel (instead of measuring oxidised and reduced S in exhaust gases) it should be assumed that all sulphur in the fuel is emitted to the atmosphere.

5.1.2. Data analysis: (COD, P, S and NO_x)

Many stakeholders acknowledged that data reported in the BREF Document for pulp and paper (JRC, 2015) continues to be representative for the European pulp and paper industry. This data could therefore be considered as a primary reference for the EU Ecolabel revision process. Consequently, the BREF Document emission data was analysed and compared with the data provided by stakeholders.

Proposed emission thresholds are expressed as specific emission load per tonne of product (pulp or paper, as applicable) with a defined moisture content. Following industry definitions, one air dry tonne (ADt) of pulp is assumed to consist of 10% water

and 90% fibre content. However, one air dry tonne (ADt) of paper is assumed to consist of 5% water and 95% fibre and other solid material.

The emission data was provided by 44 industrial pulp and/or paper mills, 26 of which represented tissue production (Table 6). Most of the pulp data was related to Kraft pulp manufacturing. No conclusive data or trends on sulphite pulp, mechanical or recycled pulp was able to be extracted from the questionnaire. This is most probably due to: (1) the high level of integration of mechanical and recycled pulp production, and (2) the limited number of operating sulphite pulp mills. Additionally, three competent bodies informed about ranges of emissions reported by the current license holders. During the course of the project, it was decided to revise the EUEL emission limits in particular consideration of the existing license holder data.

Table 6. Aggregated value ranges for singular emission parameters for pulp production collected during stakeholder consultation

Emission parameter	Min (kg/ADt)	Max (kg/ADt)
COD	0.318	27.97
P (total)	0.001	0.44
NO_x	0.010	3.45
SO_2	$0.024*10^{-2}$	1.49

The revision of EU Ecolabel emission reference values was performed according to the following methodology:

1. To establish the basic threshold for EU Ecolabel reference values at a level corresponding to 80% of the upper BAT-AELs values; in some cases this results in values that are already close to the existing EU Ecolabel reference values.

2. To maintain the scoring system and the current equation, but to reduce the maximum permitted score from 1.5 to 1.3, in order to prevent excessively high emissions for individual pollutants that would effectively exceed minimum legal requirements for EU-based pulp and paper mills.

3. To perform an individual analysis of each emission parameter, contrasting information contained in BREF with the questionnaire feedback, and to analyse if there is a possible space for further improvement.

4. To consult and reach consensus via consultation with a dedicated emission sub-group.

The scoring system

Considerable discussion took place regarding the scoring system. One proposal was to include AOX into the scoring system and thus have a total score of 5, but this could seriously reduce the overall ambition level for other emissions in cases where TCF or recycled pulp are used, which would score virtually zero for AOX.

The other main proposal was to set the upper limit for individual scores to 1.25, following from the logic that if the reference value is 80% of BREF upper AELs, then multiplying by 1.25 would mean that no higher individual emission that is equal to the BREF upper AEL would be allowed. This prompted industry stakeholders to explain that there may be many exemptions for individual plants that go above the BREF upper AEL for an individual emission AEL due to site specific circumstances. One potential compromise was to allow one parameter (any one of the four) to reach 1.5 and the others to respect 1.25. Finally, a compromise was adopted where a maximum individual score of 1.3 would apply to all four emissions.

It is worth emphasising that the individual score for an emission parameter may be the weighted average of multiple different pulp plants as well the paper machine, so that concerns with site specific emission AELs would be diluted thanks to the calculation method for obtaining individual scores.

The score of 4 (for the sum of the four emission parameter scores) was maintained and not disputed. The scoring system works in the same way as for the previous criteria, except that the upper limit of the individual score is now 1.3 instead of 1.5. If one emission score should be, for example, 1.3, then the other emission scores combined together must not exceed 2.7 in order to compensate. When considered together with any reduction in EUEL emission reference values, this reduction in flexibility amplifies the increase in ambition level considerably.

Reference value ambition level

In principle, the EU Ecolabel aims to set criteria that can be met by the top 10-20% best environmentally performing products. While it is relatively straightforward to define the top 20% of the market when looking at an individual parameter (e.g. associated COD emissions to water). However, it is much more complicated when trying to define the top 20% when accounting for multiple aspects (e.g. COD, P, S and NO_x emissions).

Industry stakeholders confirmed that from the BREF data gathering exercise, no mill was able to be amongst the best performers for all four emission parameters. Often the parameters are interlinked and in many cases when one is reduced, another tends to increase, e.g. increasing the dry solids content of the black liquor in Kraft pulp mills results in lower SO_2 emissions but higher NO_x emissions.

The COD, P, S and NOx emission reference values therefore had to be considered as a combined ambition level applied to individual mill data. It must also be emphasised that there are a number of other criteria in addition to these emissions (e.g. AOX, CO2, energy use, fibre sourcing and restricted hazardous substances). Consequently, the ambition level set for criterion 1(a) should not be interpreted as a benchmarking exercise for identifying the best mills, but rather as a part of a larger set of criteria, all of which must be complied with in order for the paper product to be able to carry the EU Ecolabel logo.

Each individual mill will therefore be able to identify a specific potential for further improvement. The current system grants flexibility at the mill level while incorporating a moderate but notable increase in ambition level beyond the platform set by work carried out in the BREF study.

In the case of integrated mills, due to the difficulties in getting separate emission figures for pulp and paper, if only a combined figure for pulp and paper production is available, the emission values for pulp(s) shall be set to zero and allocated to the paper mill. Thus the emission from paper production should include both pulp and paper production.

5.1.2.1. Chemical pulp

According to the EKONO study (EKONO, 2012), total sulphur emission (kg S/t) for European Kraft pulp mills in 2011 varied between 0.02 and 0.84 (kg S/t)[7]. In US Kraft mills average total sulphur emission was approx. 0.6 kg S/t, whereas the Canadian average was 0.7 kg S/t. The median TRS emission was around 0.17 kg S/t in Sweden and 0.18 kg S/t in Finland. The study does not specify if S-emissions related to heat and electricity generation are included in the analysis or not (EKONO, 2012).

The EUEL reference value for Kraft pulp is based on the sum of upper BAT-AEL emission thresholds for 4 sources: weak gases burners, recovery boiler, lime kiln and residual weak gases.

[7] TRS (Total sulphur emission) comprises the sum of the SO_2 and TRS emission.

For NO_x emission, the analysis included 53 mills out of which 35 (66%) meet the proposed EU Ecolabel reference level (1.6 kg NO_x/ADt).

The relevant upper BAT-AELs values set out in BAT conclusions for the production of pulp, paper and board (Decision 2014/687/EU) are as follows:

- Recovery boiler: 1.7 kg NO_x/ADt;
- Lime kiln: 0.3 kg NO_x/ADt
- TRS burner: 0.1 kg NO_x/ADt

Power boilers (including biomass boilers) generate significant NO_x emissions and are addressed by the Large Combustion Plants (LCP) BAT in Decision (EU) 2017/1442 instead of the Pulp and Paper BAT. Consultation with EUEL license holders and industry stakeholders revealed that the level of 1.6 kg NO_x/ADt is already challenging and should not be lowered any further.

Emissions of COD were analysed on the basis of data from 42 chemical pulp mills, of which 32 mills generate bleached Kraft pulp. Sixteen (50%) of bleached pulp mills meet the revised EU Ecolabel reference level of 16 kg COD/ADt. For unbleached Kraft pulp, around 10 mills (60%) meet the revised EU Ecolabel reference level of 6.5 kg COD/ADt.

Emissions of P were analysed from 42 chemical pulp mills, of which 23 (54.7%) meet the revised EU Ecolabel reference levels of 0.025 and 0.016 kg P/ADt for bleached and unbleached chemical pulp, respectively. In line with the BAT conclusions for Kraft pulp processing, a higher reference value is granted to Eucalyptus pulp (0.09 kg P/ADt instead of 0.025 kg P/ADt). Emission thresholds for P and COD from sulphite pulping (including magnefite pulp) were adapted to the general approach of 80% of upper BAT-AELs limit.

Figure 4 compares the former and revised ambition level for the proposed Criterion 1 a). The comparative analysis includes 40 Kraft pulp mills manufacturing around 18 million ADt/year. In general, the increase in ambition level for EUEL reference values varies from 0% (NO_x) to 40% (P – bleached pulp). In total, 57.5% of analysed mills demonstrate compliance with the new sub-criterion 1(a) (whereas 75% of mills could meet the previous criterion 1a). The data analysed confirms the need to maintain a flexible scoring system.

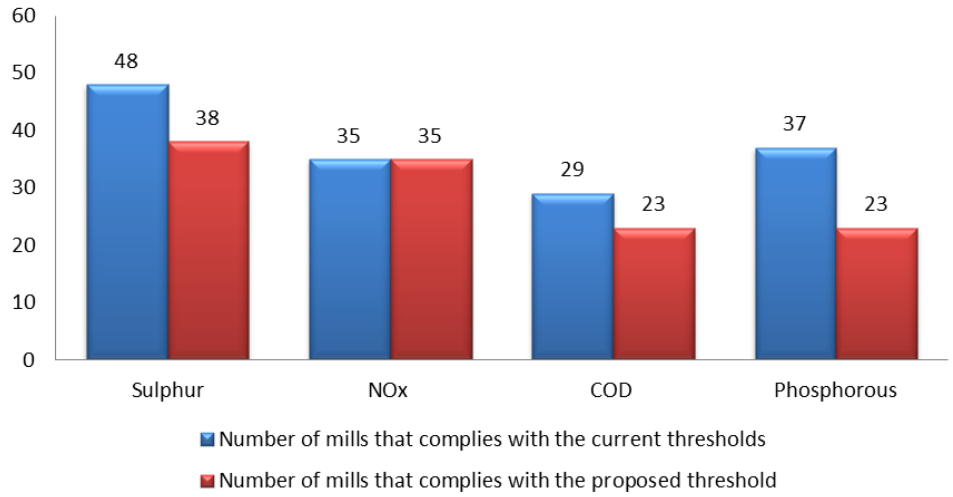


Figure 3. Change in the current and proposed ambition level of the criterion (number of compliant Kraft pulp mills indicated by BREF data).

To investigate how important the need to maintain flexibility in the scoring system is, the results of an analysis at the Kraft pulp mill level is shown in Table 7

Table 7. Comparative analysis of the previous and new emission reference values for the criterion 1(a).

Parameter	Number of mills	Comply with the former threshold (% of mills)	Comply with the revised threshold *(% of mills)*
Criterion 1(a) without a flexible score	40	15 (37.5%)	7 *(17.5%)*
Criterion 1(a) score<4, each individual parameter	40	30 (75%)	23 *(57.5%)*

The differences in results between rows 1 and 2 in Table 7 confirm the necessity of a scoring system and support the arguments of industry stakeholders about why this was necessary (i.e. too ambitious if no flexibility given to individual parameters to exceed some reference values).

5.1.2.2. Chemi-thermo-mechanical (CTMP) and Chemi-mechanical pulp (CMP)

It has been assumed that the emission of S and NO_x to air from semi-mechanical (also mechanical pulping) is closely related to indirect emissions from electricity consumption and any fuel consumed. The indirect emissions due to electricity generation onsite should be subtracted because if not, it would effectively penalise applicants that generate their own electricity onsite compared to those that purchase grid electricity. Consequently, the greater the share of electricity in the total energy consumption of the process, the lower the associated S and NO_x emissions will be.

The proposal for CTMP and CMP reference values is based on the following rationale:

- Process related emissions of S-compounds, including emissions of odorous compounds are negligible;
- There are no residues that have to be incinerated onsite, such as black liquor in sulphate (Kraft) pulping. The bark and other residues produced during wood preparation, pulping and waste water treatment might not be incinerated onsite. In fact, bark residues, reject material and sludge may be supplied to third parties as a fuel in other pulp and paper mills or biomass-fired power plants (JRC, 2015) or is used for other purposes such as soil application (Bellamy et al., 1995).
- Theoretically, the heat demand for TMP pulping and CTMP pulping can be more than compensated by waste heat recovered from the process in the form of steam and hot water.

Reported emission values from semi-chemical pulp (CTMP/CMP) and board mills vary from 0.05 to 3.1 kg/t for NO_x emission (median 0.99 kg NO_x/t), and from 0.02 to 4.6 kg/t for sulphur emission (median 0.35 kg S/t). Finnish mills reported values of 0.03 to 0.79 kg S/t for sulphur, and 1.6 to 2.1 kg NO_x/ADt (EKONO, 2012).

Reference emission values for NO_x and S are proposed to be harmonised with the Nordic Ecolabel requirements CTMP and TMP set out in the Nordic basic module for pulp and paper (0.25 kg NO_x/ADt, 0.20 kg S/ADt, respectively). However, stakeholders claimed that a non-integrated CTMP mill with steam drying of pulp and a power plant using biofuels is characterised by higher specific NO_x-emissions of 0,4 to 0,6 kg/t even with BAT techniques in place. Including advanced flash-drying techniques and recovery of impregnation chemicals, the specific NO_x emission may be as high as 0.80 kg/t. The number of mills that fall under the description is only limited since most CTMP mills are integrated with paper or board mills and/or do not use advanced drying methods and/or use non bio-based fuels. Consequently, a higher NO_x emission value was set purely for this type of CTMP mill (of 0.70 kg/ADt).

Emission reference values for COD and P for CTMP pulp reflect 80% of BAT-AELs values. This proposal was cross-checked with the information sent by the license holders.

5.1.2.3. Mechanical pulp

Air emissions from mechanical pulping stem mainly from the energy generation by combustion of different types of fuels to produce heat energy. The fraction of fuels combusted to generate electricity onsite can be subtracted

By using emission factors related to specific fuel consumption (i.e. t fuel consumed / ADt pulp) it is possible to estimate the emissions without sampling flue gases by analysing the fuel for its S content (Van Velzen, 2012).

Following the prescription of BAT 5 of Decision 2014/687/EU, initial characterisation and regular testing of the fuel can be performed by the operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee. Accordingly, it is understood that the information on fuel and possible emissions related is a common practice within the sector.

Following the EKONO study (EKONO, 2012), Swedish and Finnish mills reported total S emissions being less than 0.18 kg S/t, although it is uncertain whether electricity generation is included or not. The reference value for Nordic Ecolabel is 0.20 kg S/t. It is proposed to harmonise the reference value with the Nordic Ecolabel.

The reported median NO_x emissions were 0.17 and 0.35 kg NO_x/t in Sweden and Finland, respectively. The reference emission value for NO_x is proposed to be harmonised with the Nordic Ecolabel requirement for pulp and paper basic module (0.25 kg NO_x/ADt).

During the consultation process, the COD reference value for highly bleached TMP/groundwood pulp was proposed to be established at 5.4 kg COD/ADt. This is in line with BAT 40 of Decision 2014/687/EU, for highly bleached mechanical pulp (with 70 to 100 % of fibre content in the final paper) due to a more intense alkaline peroxide bleaching stage.

5.1.2.4. RCF pulp

In most cases, plants processing paper from recycling are integrated with paper production. The intensity of the recovery process, and the presence of some emissions pointed in Figure 4 depend mainly on the paper grade and paper properties to be achieved, and also the type of energy supply.

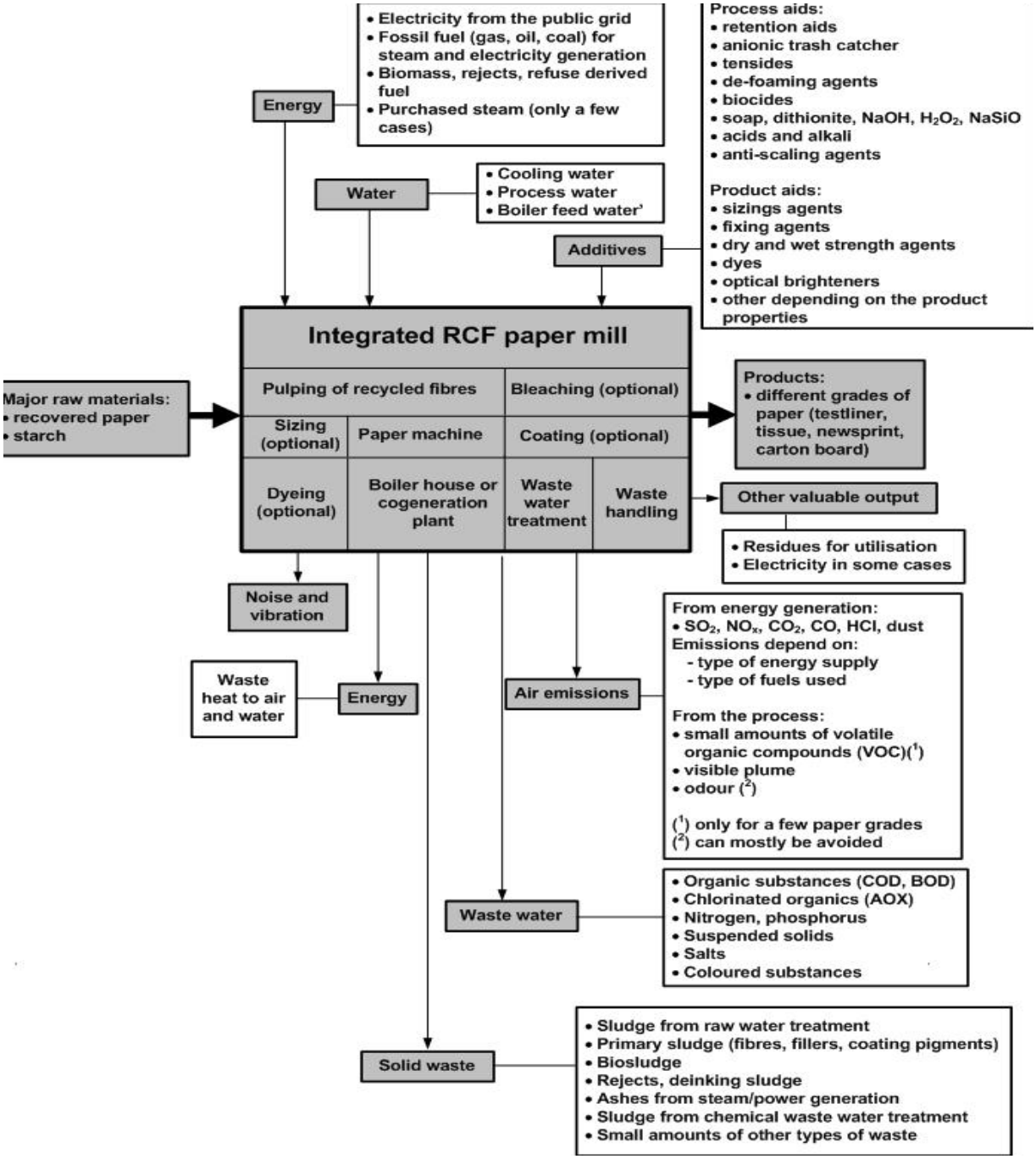


Figure 4. Mass stream overview of an integrated mill for processing paper for recycling (JRC, 2015).

As with mechanical pulping processes, emissions to air from RCF pulp mills originate mainly from energy generation (steam and electricity) and to a lesser extent from the manufacturing process itself.

Emission values for NO_x and S for recycled fibre pulp production are proposed to be harmonised with the Nordic Ecolabel requirement for pulp and paper basic module (0.20 kg S/ADt, and 0.25 kg NO_x/ADt).

5.1.2.5. Paper machine

Total sulphur emission from non-integrated paper production in 2011 in Europe was estimated to vary between 0.00 and 0.5kg S/ADt, and between 0.06 and 0.64 kg NO_x/ADt for NO_x emission (EKONO, 2012). Nordic Swan criteria establishes the threshold

value at the level of: (1) 0,3 kg S/tonne, and of 0,7 NOx/tonne for paper machine (coated and uncoated paper), (2) 0,5 kg S/tonne for paper machine for speciality paper.

As to the tissue paper and tissue product, BAT 50 specifically addresses the COD and P emission ranges that should be met.

Table 8. Comparison of BAT AELs and EUEL reference values COD and P emissions (BAT 50 of Decision 2014/687/EU).

Parameter	BAT-AELs Yearly average (kg/t)	New EUEL reference values Graphic	Tissue
COD	0.15 to 1.4	1.10	1.20
Total P	0.003 – 0.012	0.008	0.01

5.2. Criterion 1b) AOX

Graphic Paper / Tissue Paper and Tissue Products
This criterion refers to elemental chlorine free (ECF) pulp. The AOX emissions from the production of each pulp used in EU Ecolabel graphic paper shall not exceed 0.17 kg/ADt.
Assessment and verification: *The applicant shall provide test reports using the AOX ISO 9562 test method or equivalent methods, accompanied by detailed calculations showing compliance with this criterion and any related supporting documentation.* *The applicant shall provide a declaration of compliance with this criterion, supported by a list of the different ECF pulps used in the pulp mix, their respective weightings and their individual amount of AOX emissions, expressed as kg AOX/ADt pulp.* *The supporting documentation shall include an indication of the measurement frequency. AOX shall only be measured in processes where chlorine compounds are used for bleaching the pulp. AOX does not need to be measured in the effluent from non-integrated paper production or in the effluents from pulp production without bleaching or where bleaching is performed with chlorine-free substances.* *Measurements of AOX emissions to water shall be taken on unfiltered and unsettled samples at the effluent discharge point of the mills' wastewater treatment plant. In cases where mill effluent is sent to a municipal or other third-party wastewater treatment plant, unfiltered and unsettled samples from the mill effluent sewer discharge point shall be analysed and the results multiplied by a standard removal efficiency factor for the municipal or third-party wastewater treatment plant. The removal efficiency factor shall be based on information provided by the operator of the municipal or other third-party wastewater treatment plant.* *Information on the emissions shall be expressed as the annual average from measurements taken at least once every 2 months. In case of a new or rebuilt production plant, measurements shall be based on at least 45 subsequent days of stable running of the plant. They shall be representative of the respective campaign.* *In case the applicant does not use any ECF pulp, a corresponding declaration to the competent body is sufficient.*

5.2.1. Background

Absorbable Organic Halogens (AOXs) have been associated with acutely toxic, chronically toxicity and mutagenic effects in living organisms (Chaparro and Pirres, 2011). The key source of AOX emissions in the pulp and paper industry is attributed to the reaction between residual lignin and free chlorine or chlorine compounds used for bleaching process.

Emissions of AOX emissions have reduced significantly in the last 20 years in the European pulp sector largely due to widespread use of elemental chlorine free (ECF) techniques where elemental chlorine (Cl_2) is typically replaced with more stable chlorine

dioxide (ClO_2), due to the optimisation of bleaching sequences to reduce specific ClO_2 consumption and also due to the development of total chlorine free (TCF) bleaching sequences which use chemicals such as molecular oxygen (O_2), hydrogen peroxide (H_2O_2), ozone (O_3) or peracetic acid (CH_3CO_3H).

The intensity of the bleaching process will depend on the initial kappa number (which indicates the content of residual lignin) that is achieved prior to pulp bleaching and the degree of whiteness that is expected for the final product. The raw wood species used influences the process chemistry e.g. softwood vs hardwood (JRC, 2015).

Effluent toxicity and the potential formation of dioxins and dioxin-like compounds were stressed as arguments to further lower the AOX emission threshold. A review of the literature revealed divergent views in the scientific community about the potential effect of given AOX emissions on environmental toxicity (Pryke and Barden, 2006; Chaparro and Pirres, 2011).

The shift towards ECF and TCF bleaching processes in the last 20 years has been driven by the objective of decreasing the discharge of chlorinated organic matter (AOX). The use of chlorine gas and sodium hypochlorite as bleaching chemicals was common practise until the mid-1980s. In Europe, where elemental chlorine is no longer used, AOX emissions have declined by over 95% since 1990 (OECD, 2015). European pulp and paper mills have invested heavily in the technology of anaerobic treatment, a process favoured by the high concentrations of organic matter usually found in industrial effluents (Pokhrel and Virarghavan, 2004).

According to stakeholder input, the total organically bound chlorine in pulp (TOX as measured according to ISO 11480) typically varies between 100-200 mg Cl/kg of pulp. The potential for dioxin (2,3,7,8 tetra chlorodibenzo-p-dioxin) and furan (2,3,7,8 tetra chlorodibenzofuran) formation has been reported to be drastically reduced when ClO_2 is used instead of Cl_2 as a first stage bleaching agent, reaching non-detectable concentrations at substitution levels over 50% (Gonzales and Zaror, 2000). The non-detection of highly chlorine substituted phenolic compounds in ECF mill effluents has been reported in the literature (Pryke et al., 2006, Takagi et al., 2007). Nakamat and Ohi (2003), concluded that the main source of 1,3,6,8- and 1,3,7,9-tetrachlorodibenzo-p-dioxins in the process water from ECF pulp mill could be agrochemical contamination in water abstracted from the local river. In terms of untreated wastewater toxicity, Ahtiainen et al., (2000) found that debarking wastewaters and black liquor where even more toxic than bleaching wastewater. Verta et al., (1996) indicated that the natural constituents of wood should also be considered as one of the possible halogen sources for AOX emissions in bleaching effluents.

The discussion conducted, and feedback gathered from various proposals presented by JRC during the revision process lead to the conclusion that a compromise should be found in order to establish a threshold which:

- is realistic and achievable by companies;
- recognises the differences between integrated and non-integrated production;
- is sufficiently ambitious to deliver a reduction of environmental impact and to respect the potential of best available techniques. (BAT 19 states the upper BAT-AEL value for Kraft pulp as 0.20 kg AOX/ADt).

The AOX emission criteria in the previous Commission Decisions for Copying and Graphic Paper and Tissue Paper were structured in a different way. Consequently, it was suggested to harmonise the structure but it was necessary to agree first on the preferred option (or on a new structure). The two previous approaches were:

- For Copying and Graphic Paper: A maximum AOX emission of 0.17 kg/ADt was set for any pulp produced using chlorine compounds as bleaching agents.

- For Tissue Paper: A maximum AOX emission of 0.25 kg/ADt was set for any pulp produced using chlorine compounds as bleaching agents and the weighted average pulp AOX emission must not exceed 0.12 kg AOX/ADt.

The second approach appears to be more ambitious, but upon closer inspection, it was evident that any pulp that does not use any chlorine compounds for bleaching can be assigned a zero AOX emission value and used in the weighted average calculation.

The first approach was preferred since it focussed precisely on the pulps where AOX emissions are a concern in the first place and does not afford any room for interpretation in calculations.

Ambition level

Traditionally the tissue paper sector has strongly relied on market pulp. Consequently, there is a certain degree of freedom when trying to comply with the AOX emission criteria that is based on the pulp stage (i.e. look for suppliers that can meet the criteria). However, industry stakeholders stated that the tissue paper sector is shifting towards a more integrated production model. Globally around 11% of tissue capacity is integrated with a chemical pulp mill (Papakostas, 2017) and a higher figure can be expected in Europe, a figure that will tend to rise in the next few years as well.

Although integrated pulp and paper production has several environmental benefits, the pulp mill will rely heavily on the local wood supply and have limited flexibility to source any different raw wood material due to transport costs and logistics.

One integrated mill in France, which sources raw wood from locally grown Chestnut trees, was claimed to be unable to reduce AOX emissions further below 0.16 kg AOX/ADt, despite multi-million € investments to optimise bleaching and reduce AOC emissions. It was not possible to achieve lower AOX emissions when bleaching due to the high tannin content of chestnut. A similar situation was expected to apply to oak tree species as well.

5.2.2. Data analysis: AOX

Data collected from a 2nd stakeholder questionnaire reiterated the information obtained from the data collected for the pulp and paper BREF exercise (JRC, 2015). Specific AOX emissions from bleached Kraft pulp mills after waste water treatment vary from below detection limits to around 0.3 kg AOX/ADt of bleached Kraft pulp (**Figure 5**).

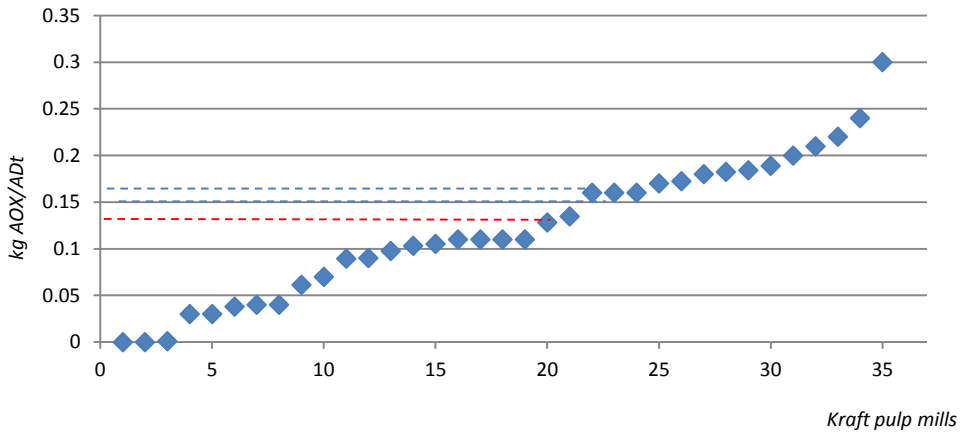


Figure 5. AOX emission levels for bleached Kraft pulp (JRC, 2015)

In order to assess the ambition level of criterion 1(b), AOX emission data from bleached Kraft pulp mills was contrasted with the production capacity of the same mills. Data for

AOX emissions covered 37 mills that accounted for approximately 15.3 million tonnes of the total estimated 21.5 million tonnes of bleached Kraft pulp production in Europe in 2016 (UNFAO, 2018) based on FAOSTAT production data).

During the consultation process it was proposed to lower the AOX limit to 0.1 kg AOX/ADt. A comparison of how much production capacity (of the 37 mils analysed) would be able to meet different proposed AOX emission limits (ranging from 0.17 to 0.10 kg AOX/ADt) is shown in Figure 6.

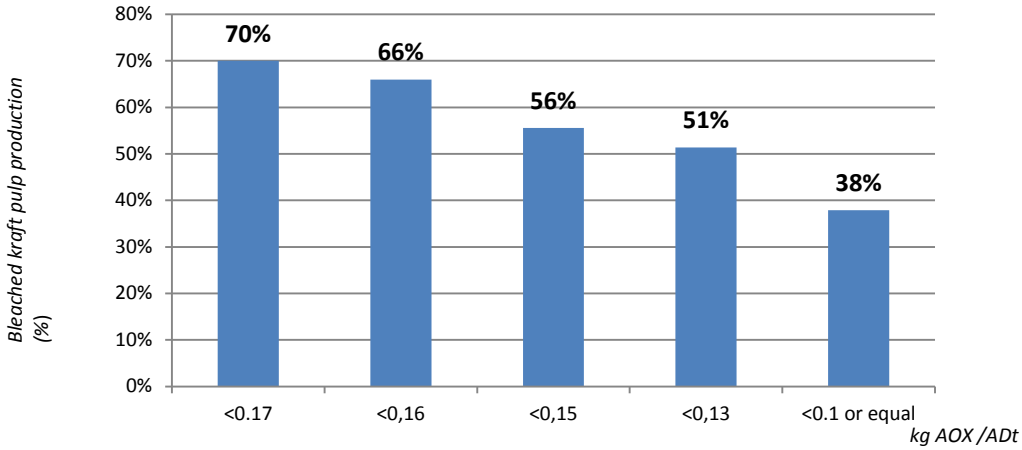


Figure 6. Bleached Kraft pulp production capacity able to meet different AOX emission limits

From the data above it is clear that the proposal of 0.1 kg AOX/ADt would exclude 62% of the analysed bleached Kraft pulp from EU Ecolabel production. This was considered as too ambitious for what is one single pass-fail criterion within a much wider set of pass-fail criteria.

Furthermore, due to concerns about possible discrimination of particular wood species and local regions, and with the aim of keeping the criterion as simple as possible to assess and verify, it was decided to establish a fixed value of 0.17 kg AOX/ADt for each bleached chemical pulp used in the pulp mix. Pulp that is bleached using the TCF process can be assumed to comply with this requirement without any analysis because it does not use any chlorine containing compounds. Consequently, the limits refer to ECF bleached pulps.

5.3. Criterion 1c) CO_2

Graphic Paper
Carbon dioxide emissions from fossil fuels used for the production of process heat and electricity (whether on-site or off-site) must not exceed the following limit values: 1) 1 100 kg CO_2/tonne for paper made from 100 % de-inked/recycled pulp; 2) 1 000 kg CO_2/tonne for paper made from 100 % chemical pulp; 3) 1 600 kg CO_2/tonne for paper made from 100 % mechanical pulp. For paper composed of any combination of chemical pulp, recycled pulp and mechanical pulp, a weighted limit value shall be calculated based on the proportion of each pulp type in the mixture. The actual emission value shall be calculated as the sum of the emissions from the pulp and paper production, taking into account the mixture of pulps used.
***Assessment and verification**: The applicant shall provide data and detailed calculations showing compliance with this criterion, together with related supporting documentation.* *For each pulp used, the pulp manufacturer shall provide the applicant with a single CO_2 emission value in kg CO_2/ADt. The applicant shall also provide a single CO_2 emission value for the relevant paper machine(s) used to produce EU Ecolabel graphic paper. For integrated mills, CO_2 emissions for pulp and paper production may be reported as a single value.* *To define the maximum CO_2 emissions allowed, the applicant shall define the pulp mix in terms of pulp type (i.e. chemical pulp, mechanical pulp and recycled pulp).* *To calculate the actual CO_2 emissions, the applicant shall define the pulp mix in terms of individual pulps supplied, calculate the weighted average CO_2 emissions for pulp production and add this value to CO_2 emissions from the paper machine(s).* *The CO_2 emission data shall include all sources of non-renewable fuels used during the production of pulp and paper, including the emissions from the production of electricity (whether on-site or off-site).* *Emission factors for fuels shall be used in accordance with Annex VI of Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions[8].* *For grid electricity, an emission calculation factor of 384 (kg CO_2/MWh) shall be used in accordance with the MEErP methodology[9].* *The period for the calculations or mass balances shall be based on the production over 12 months. In case of a new or rebuilt production plant, the calculations shall be based on at least 45 subsequent days of stable running of the plant. The calculations shall be representative of the respective campaign.* *For grid electricity, the value provided above (the European average) shall be used unless the applicant presents documentation establishing the average value for its suppliers of electricity (contracting suppliers), in which case the applicant may use this value instead of the value quoted. The documentation used as proof of compliance shall include technical specifications that indicate the average value (i.e. copy of a contract).* *The amount of energy from renewable sources purchased and used for the production processes counts as zero CO_2 emission when calculating CO_2 emissions. The applicant shall provide appropriate documentation that this kind of energy is actually used at the mill or has been externally purchased.*
Tissue Paper and Tissue Products
Note: The criterion refers to the sum total of CO_2 emissions from pulp and paper manufacturing processes. Conversion is not included. Carbon dioxide emissions from fossil fuels used for the production of process heat and electricity (whether on-site or off-site) must not exceed the following limit values: 1) 1 200 kg CO_2/tonne for conventional tissue paper, 2) 1 850 kg CO_2/tonne for structured tissue paper. The actual emission value shall be calculated as the sum of the emissions from the pulp and paper production, taking into account the mixture of pulps used.
***Assessment and verification**: The applicant shall provide data and detailed calculations showing compliance with this criterion, together with related supporting documentation.*

[8] OJ L 181, 12.7.2012, p. 30-104.
[9] Methodology for the Ecodesign of Energy-related Products

For each pulp used, the pulp manufacturer shall provide the applicant with a single CO_2 emission value in kg CO_2/ADt. The applicant shall also provide a single CO_2 emission value for the relevant paper machine(s) used to produce EU Ecolabel tissue paper. For integrated mills, CO_2 emissions for pulp and paper production may be reported as a single value.

The CO_2 emission data shall include all sources of non-renewable fuels used during the production of pulp and paper, including the emissions from the production of electricity (whether on-site or off-site).

Emission factors for fuels shall be used in accordance with Annex VI of Commission Regulation (EU) No 601/2012.

For grid electricity, an emission calculation factor of 384 (kg CO_2/MWh) shall be used in accordance with the MEErP methodology[10].

The period for the calculations or mass balances shall be based on the production over 12 months. In case of a new or a rebuilt production plant, the calculations shall be based on at least 45 subsequent days of stable running of the plant. The calculations shall be representative of the respective campaign.

For grid electricity, the value provided above (the European average) shall be used unless the applicant presents documentation establishing the average value for its suppliers of electricity (contracting suppliers), in which case the applicant may use this value instead of the value quoted. The documentation used as proof of compliance shall include technical specifications that indicate the average value (i.e. copy of a contract).

The amount of energy from renewable sources purchased and used for the production processes counts as zero CO_2 emission when calculating CO_2 emissions. The applicant shall provide appropriate documentation that this kind of energy is actually used at the mill or has been externally purchased.

[10] *Methodology for the Ecodesign of Energy-related Products*

5.3.1. Main sources of CO_2 emissions

Direct emissions of CO_2 are mainly caused by onsite combustion of fuels to produce heat and, in cases where Combined Heat and Power (CHP) plants are used, electricity for the pulp and papermaking processes. Indirect emissions of CO_2 are caused by the consumption of grid electricity (which accounts for around 62% of the total electricity consumption in the sector). Non energy-related emission sources include the decarbonation of calcium carbonate in Kraft and soda pulp lime kilns and CO_2/CH_4 emissions from wastewater treatment processes. The main emissions of direct CO_2 and other GHG in the pulp and paper manufacturing industry are listed in Table 9 below (US EPA, 2010).

Table 9. Stationary direct GHG emission sources in the pulp and paper manufacturing sector.

Emission Source	Types of pulp and paper mill where emission source typically are located	Type of GHG emission
Fossil fuel and/or biomass boiler	All types of pulp and paper mills	Fossil CO_2, CH_4, N_2O biogenic CO_2, CH_4, N_2O)
Thermal oxidizers and regenerative thermal oxidizers (RTOs)	Kraft pulp and semi-chemical pulp mill (for combustion unit control)	Fossil CO_2, CH_4, N_2O,
Direct-fired dryers	Gas-fired dryers at some pulp and paper mills	Fossil CO_2, CH_4, N_2O
Combustion turbines	All types of pulp and paper mills	Fossil CO_2, CH_4, N_2O
Chemical recovery furnace – Kraft & soda	Kraft and soda pulp mills	Fossil CO_2, CH_4, N_2O Biogenic CO_2, CH_4, N_2O
Chemical recovery furnace - sulphite	Sulphite pulp mills	Fossil CO_2, CH_4, N_2O Biogenic CO_2, CH_4, N_2O
Chemical recovery combustion units – stand-alone semi-chemical	Stand-alone semi-chemical pulp mills	Fossil CO_2, CH_4, N_2O Biogenic CO_2, CH_4, N_2O
Kraft and soda lime kilns	Kraft and soda pulp mills	Fossil CO_2, CH_4, N_2O Process biogenic CO_2
Makeup chemicals ($CaCO_3$, Na_2CO_3)	Kraft and soda pulp mills	Process CO_2
Flue gas desulfurization system	Mills that operate coal-fired boilers required to limit SO_2 emission	Process CO_2
Anaerobic waste water treatment	Chemical pulp mills (Kraft mostly)	Biogenic CO_2, CH_4
On-site landfills	All types of pulp and paper mills	Biogenic CO_2, CH_4

Emissions of CO_2-generally belong to one of two main approaches (Antalis, 2015):

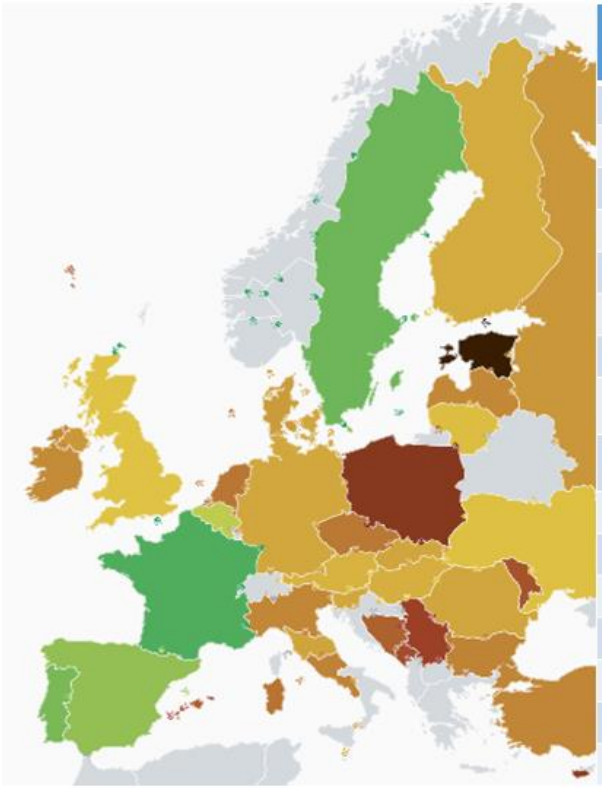
- Optimise energy production equipment onsite: BAT for recovery boilers, power boilers and CHP units, distribution systems and insulation, and
- Substitution of fossil fuels for less carbon intensive fossil fuels in heat and/or electricity production (e.g. coal for natural gas or biomass for natural gas).

Fossil carbon emissions from the consumption of any grid electricity need to be accounted for when demonstrating compliance with criterion 1c) for EU Ecolabel Graphic Paper, Tissue Paper or Tissue Products.

5.3.2. Grid electricity carbon intensity

Electric utilities represent the single largest emission source in the EU-28. The actual carbon intensity will vary as a function of the primary energy source(s) used by the electric utility. All the electric utilities combined in a specific region or Member State contribute to an average energy mix for that region or Member State based on the primary energy mix used.

In reality, the primary energy mix, and thus the carbon intensity of the energy mix, is a dynamic number which can vary as a function of solar intensity, wind speeds and whether or not auxiliary hydro turbines and gas turbines are being run during periods of high demand or not. The real time carbon intensity of grid electricity consumed and produced can actually be monitored in Europe via a platform called Electricity Map. An example snapshot of values from the platform is provided below.



Member State	Carbon intensity (g CO2 eq./kWh)
Austria	293
Belgium	156
Bulgaria	426
Czech. Rep.	449
Estonia	1123
France	41
Germany	310
Hungary	306
Ireland	401
Italy (regions)	310 - 455
Netherlands	464
Poland	642
Portugal	85
Spain	109
Sweden	69
United Kingdom	241

Figure 7. Snapshot of live average carbon intensity of consumed electricity by Member State or sub-regions (Source: EM, 2019).

For the sake of the EU Ecolabel criteria, and for simplifying assessment and verification efforts, it would not make sense to refer to real time carbon intensities of grid electricity. Even if these values were somehow to be used, they represent regional or national averages and do not necessarily match the actual carbon intensity of the supplier providing grid electricity to the EU Ecolabel applicant/license holder.

Another aspect to consider is that the EU Ecolabel applicant/license holder has no control over the carbon intensity of the grid electricity that their supplier can provide. Consequently, in order to avoid regional discrimination, applicants/license holders are permitted to use a defined EU28 average carbon intensity for grid electricity (384 g/kWh). This value was chosen based on the MEErP methodology where an average grid electricity of 384 kg $CO_{2\ eq.}$ / MWh is assumed for the period 2010 to 2020 (VHK, 2011).

By fixing the EU28 average grid electricity carbon intensity as a single number, potential applicants and existing license holders can assess and calculate with certainty whether any future changes to their energy balances would jeopardise compliance with criterion 1c) or not.

However, it must also be recognised that by fixing the carbon intensity of grid electricity to a single value, there is no incentive for potential applicants and existing license holders to purchase electricity from suppliers that have lower carbon intensities than 384 g CO_2/kWh. In order to incentivise this behaviour, criterion 1c) also makes provision for applicants to justify a different value from 384 g CO_2/kWh if they provide appropriate evidence from their electricity supplier.

5.3.3. Fuel CO_2 emission factors

The method used to estimate CO_2 emissions from fuel consumption during pulp and paper production is the same as the previous EU Ecolabel criteria but makes reference to a different source of assumed emission factors. In general, the estimation of CO_2 emission from fuel combustion for a given fuel is the product of the mass of fuel consumed and the emission factor per unit weight mass (IEA 2016).

The emission factors for fuel combustion are those used by IEA and based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPPC, 2006).These emission factors take into account emissions of fossil carbon.

Fuel emission factors related to net calorific value (NCV) and net calorific values per mass of fuel are proposed to be related to Regulation (EU) No 601/2012 on the monitoring and reporting of greenhouse gas emissions, providing carbon intensities for a larger number of fuels than were stated in the previous EU Ecolabel criteria.

Table 10. Fuel emission factors related to net calorific value (NCV) and mass of fuel.

Fuel type description	Emission factor (t CO2/TJ)	Net calorific value (TJ/Gg)	Source
Crude oil	73,3	42,3	IPCC 2006 GL
Orimulsion	77,0	27,5	IPCC 2006 GL
Natural gas Liquids	64,2	44,2	IPCC 2006 GL
Motor gasoline	69,3	44,3	IPCC 2006 GL
Kerosene (other than jet kerosene)	71,9	43,8	IPCC 2006 GL
Shale oil	73,3	38,1	IPCC 2006 GL
Gas/Diesel oil	74,1	43,0	IPCC 2006 GL
Residual fuel oil	77,4	40,4	IPCC 2006 GL
Liquefied petroleum gases	63,1	47,3	IPCC 2006 GL
Ethane	61,6	46,4	IPCC 2006 GL
Naphtha	73,3	44,5	IPCC 2006 GL
Bitumen	80,7	40,2	IPCC 2006 GL
Lubricants	73,3	40,2	IPCC 2006 GL
Petroleum coke	97,5	32,5	IPCC 2006 GL
Refinery feedstocks	73,3	43,0	IPCC 2006 GL
Refinery gas	57,6	49,5	IPCC 2006 GL
Paraffin waxes	73,3	40,2	IPCC 2006 GL
White spirit and SBP	73,3	40,2	IPCC 2006 GL
Other petroleum products	73,3	40,2	IPCC 2006 GL
Anthracite	98,3	26,7	IPCC 2006 GL
Coking coal	94,6	28,2	IPCC 2006 GL
Other bituminous coal	94,6	25,8	IPCC 2006 GL
Sub-bituminous coal	96,1	18,9	IPCC 2006 GL
Lignite	101,0	11,9	IPCC 2006 GL
Oil shale and tar sands	107,0	8,9	IPCC 2006 GL
Patent fuel	97,5	20,7	IPCC 2006 GL
Coke oven coke and lignite coke	107,0	28,2	IPCC 2006 GL
Gas coke	107,0	28,2	IPCC 2006 GL
Coal tar	80,7	28,0	IPCC 2006 GL
Gas works gas	44,4	38,7	IPCC 2006 GL
Coke oven gas	44,4	38,7	IPCC 2006 GL
Blast furnace gas	260	2,47	IPCC 2006 GL
Oxygen steel furnace gas	182	7,06	IPCC 2006 GL
Natural gas	56,1	48,0	IPCC 2006 GL
Industrial wastes	143	n.a.	IPCC 2006 GL
Waste oils	73,3	40,2	IPCC 2006 GL
Peat	106,0	9,76	IPCC 2006 GL
Waste tyres	85,0	n.a.	WBCSD CSI
Carbon monoxide	155,2	10,1	*
Methane	54,9 (2)		

** J. Falbe and M. Regitz, Römpp Chemie Lexikon, Stuttgart, 1995*

EU Ecolabel license holders and potential applicants therefore need to keep records of fuel consumption, which can be considered to be normal practice for any installation that

is reporting under the EU Emissions Trading Scheme. It is also necessary that the pulp and paper producers are able to allocate the fuel consumption to their actual production of pulp or paper onsite.

5.3.4. Approach to CO_2 criterion

Although CO_2 emission criteria have been set for both Graphic Paper and for Tissue Paper and Tissue Products and both products can be based on the same types of pulp, it was necessary to define different ambition levels in terms of ADt of final paper product due to fundamental differences in the paper machine and associated energy requirements that are required to produce tissue paper.

Apart from the ambition level, stakeholder feedback for both sub-products led to different formulations of the CO_2 criterion in Annex I (Graphic Paper) and Annex II (Tissue Paper and Tissue Products).

Annex I. Graphic Paper:

For Graphic Paper, the limit for total CO_2 emissions (comprising pulp production and the paper machine) will vary between 1000 and 1600 depending on the average pulp mix. The following values are defined for theoretical cases where only one pulp type is used:

- 1100 kg CO_2 /tonne paper for paper made from 100 % DIP/recycled pulp;
- 1000 kg CO_2 /tonne paper for paper made from 100 % chemical pulp;
- 1600 kg CO_2 /tonne paper for paper made from 100 % mechanical pulp;

This approach was requested because it is in line with equivalent Nordic Ecolabel criteria. The significantly higher value allowed for mechanical pulp production is based on its reliance to use electricity as the main energy source instead of fuels. Even though the production of chemical pulp is by far the most energy intensive pulping process, the CO_2 reference value is actually lower that than of recycled pulp and much lower than mechanical pulp due to high proportion of bio-based fuel sources used and the efficient recovery of energy from black liquor waste.

This approach was requested during the stakeholder consultation process in order to align with the Nordic Ecolabel approach and ambition level.

Annex II. Tissue paper and Tissue Products:

Following on the new approach for Graphic Paper CO_2 emissions, stakeholders from the tissue paper industry were consulted about whether a similar approach would be desirable. However, discussions focussed more on the potential distinction of CO_2 emissions based on the nature of the tissue paper rather than the pulp mix used.

Two main distinctions for tissue base paper were made: "*conventional*" and "*structured*". Structured tissue has different technical properties such as an approximate doubling of bulk and absorption capacity for the same base sheet grammage (PA, 2016). These are due to a heterogeneous nature of the base sheet structure, with areas high and low fibre density which results in air pockets in the sheet (see Figure 8).

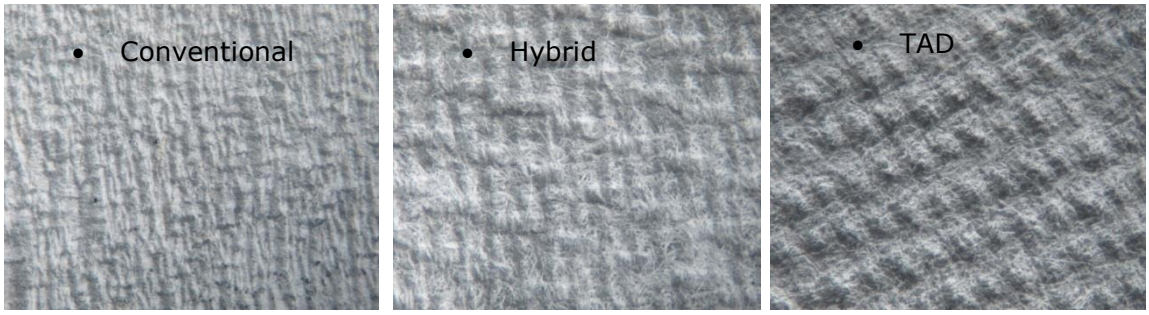


Figure 8 Microscopic image of fibre structure from a) conventional, b) hybrid, and c) TAD process (Source: personal communication).

These higher quality properties are particularly attractive in kitchen-towel and hand-towel products, but require a different method of drying the paper sheet that is more energy intensive. The extra cost and environmental impact of increased energy use is partially offset by a lower fibre requirement per sheet area and the possibility to produce lower ply products for a given absorption performance, providing further fibre savings and potential transport savings (PA, 2016; TWM, 2017).

All tissue paper production involves the removal of water by physical action and thermal drying. The difference in technical properties and specific energy consumption of conventional and structured tissue paper is related to how a certain fraction of water is removed during the sheet forming and drying process. In conventional tissue base sheet production, more water is removed by mechanical pressing. Structural tissue base sheet production substitutes some of this mechanical pressing for through air drying (TAD) to remove a part of the water content. In the TAD process, hot process air is blown through the sheet.

At the inlet end of a paper machine, a homogenous slurry of pulp, containing about 99% water and 1% fibre is first spread onto a drying fabric where water drains through by gravity and cellulose fibres are retained. The remaining water is then removed by a combination of mechanical pressing and hot-air drying, depending on the technology used. One industry stakeholder used the following simplified numbers to explain the difference between a conventional tissue machine and a TAD tissue machine:

- **Conventional**: filtration to 20%, pressing to **40%**, drying to 95% solids.
- **TAD**: filtration to **20%**, drying to 95% solids.

The key difference is the solids content when the sheet is transferred to the drying stage (highlighted in bold above). The lower the solids contents, the more water that needs to be evaporated by heat in the dryer and the higher the specific energy requirement.

Mechanical pressing is much more energy efficient than drying but results in a more compacted sheet that is unable to exhibit the same bulk and liquid absorption properties of structured tissue base sheet. The traditional TAD process has a specific energy consumption of around 2.25 times higher than conventional paper making but can deliver products with 90% greater absorption (OnePly). This higher energy consumption is linked both to higher fuel consumption to produce more hot air to evaporate the water that was not removed by mechanical pressing plus higher electricity consumption to drive fans and vacuums to generate a negative pressure for optimum removal of moisture vapour (JRC 2015, Laurijssen 2010).

Efforts to reduce the energy consumption of the TAD process, without compromising the structured tissue base paper characteristics, have led to development of hybrid technologies (e.g. Atmos, NTT) which, according to the same industry stakeholder, would work according to these simplified numbers:

- **Hybrid**: filtration to 20%, pressing to **30%**, drying to 95%.

The Nordic Ecolabel follow the same calculation approach as the EU Ecolabel criteria for CO2 emissions (i.e. counting CO_2 emissions from purchased electricity and from burning of fossil fuels for both heating and internal electricity generation for pulp and paper production). The Nordic Ecolabel sets limits of 1100 kg CO_2/tonne tissue paper. The previous limit for EU Ecolabel Tissue Paper was 1500 kg CO_2/ADt tissue paper.

Stakeholders confirmed that alignment with the ambition level for Nordic Ecolabel would effectively exclude structural tissue products from obtaining the EU Ecolabel. Considering the growing presence of structured tissue products on the market and the fact that these have a tendency to be high end consumer facing products, it was argued that a higher limit be set for structural tissue products so long as they are associated with some

guarantee of superior performance (i.e. minimum water absorption of 10.0 g H_2O/g tissue as per criterion 6d).

This was one of the reasons why the JRC conducted a further data gathering exercise for specific CO_2 emissions and specific energy consumption.

5.3.5. Data analysis: CO_2

The other main reason for the data gathering exercise and subsequent analysis was that during the early stages of the criteria revision process, some stakeholders requested that either CO_2 emissions or energy efficiency criteria should be removed since they are effectively two sides of the same coin and only serve to increase assessment and verification efforts without addressing any additional environmental concerns. This argument prompted the JRC to analyse existing data and to request new date via the 2nd stakeholder questionnaire.

Data for both CO_2 emissions and specific energy consumption was obtained for over 30 different pulp mills or paper mills, which allowed for a correlation of the values to be plotted in Figure 9 below.

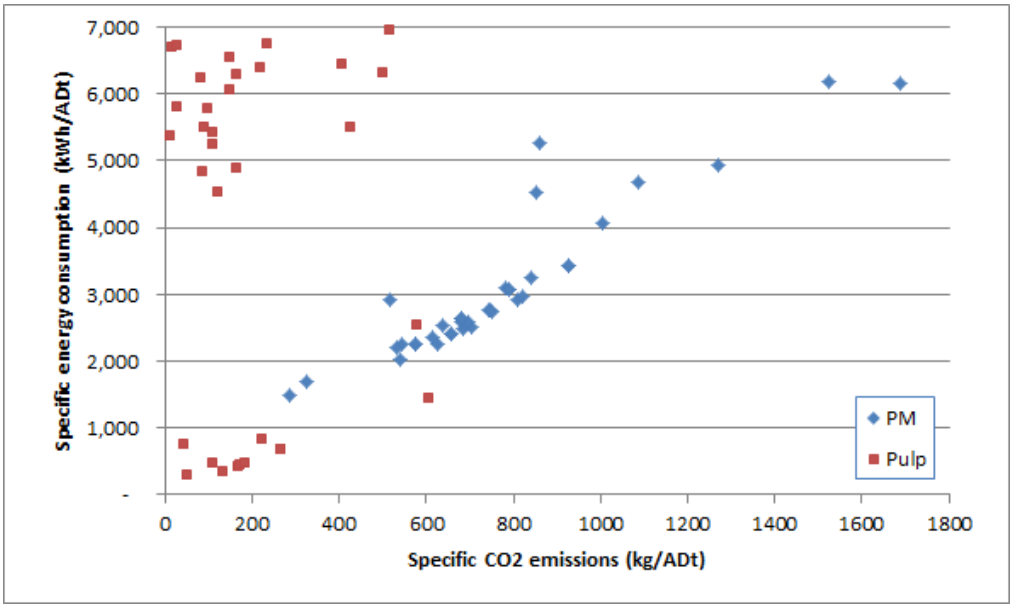


Figure 9. Relationship between specific energy consumption and specific CO_2 emissions in pulp production and paper machines (PM).

From the data above, it is clear that paper machines follow a general correlation between specific energy consumption and specific CO_2 emissions. Such a relationship can be expected especially in non-integrated mills where natural gas generated steam is used for drying the sheet and where grid electricity is used.

When looking at the pulp data, it is clear that there are divergent relationships. Some pulp mills showed the same proportional relationship as the paper machines. These types of pulp mill probably use natural gas and grid electricity for to meet their energy needs. Mechanical pulp and RCF pulp mills could fit such a practice. The lower specific energy requirements are more typical of RCF pulp mills, since it is easier to separate fibres from paper than from wood. However, the majority of the pulp mills included in the data gathering exercise showed a different relationship, where high specific energy consumption was associated with low specific CO_2 emissions. Such data is more typical of chemical pulp production, which requires large amounts of energy but most of that energy (both heat and electricity) can be generated from biomass residues and recovered black liquor.

The lack of a uniform relationship between specific energy consumption and specific CO_2 emissions justifies the need to maintain a criterion on both energy efficiency and CO_2 emissions in the EU Ecolabel criteria for Graphic Paper, Tissue Paper and Tissue Products.

Ambition level

Considering the data providing as a function of mill type, specific CO_2 emission values ranged as follows:

- From 13 to 610 kg CO_2/ADt for pulp production.
- From 280 to 1090 CO_2/kg for conventional tissue paper machine.
- From 1250 to 1700 CO_2/kg for structural tissue paper machine.

Due to the fact that the EU Ecolabel requirement for CO_2 emissions is a single value that sums up emissions for both pulp and paper production, whereas the data collected was generally for non-integrated mills, it was not straight-forward to justify one particular ambition level due to the many different combinations of pulp that could be used.

From the ranges stated in the points above, it is clear that the dominant energy consumption stage is the tissue paper machine. Despite the wide range of values collected, it is worth highlighting that the scope for CO_2 reductions in tissue paper machines in terms of fuel choice is generally limited due to the well-established use of natural gas in dryers. Natural gas has the advantages of a stable supply, chemical composition and proven performance.

With regards to CO_2 emissions due to electricity consumed by on the tissue paper machine, Nordic countries have widespread availability of low carbon intensity grid electricity (see Figure 7). This is not the case throughout Europe and, after consultation with existing license holders and some Competent Bodies, it was stated that aligning with the 1100 kg CO_2/ADt ambition level of the Nordic Ecolabel would result in the loss of a number of licenses. As a compromise, it was agreed to set a final value of 1200 kg CO_2/ADt for conventional tissue paper, which still represents a significant reduction from the previous level of 1500 kg CO_2/ADt.

During the consultation process, it was requested to add a specific value for structural paper of 2000 kg CO_2/tonne paper. Such an increase could be justified based on the higher range of specific CO_2 values at the level of the tissue paper machine stated in the bullet points above. However, other stakeholders wanted to only allow an increase in CO_2 emissions that would be offset by fibre savings (the same argument applies to the distinction in ambition levels for specific energy consumption reference values in criterion 2). Tissue that is manufactured with the use of TAD or hybrid process is denominated structured tissue, being characterized by a high bulk and absorbance capacity. Confidential data provided to the JRC from the tissue paper industry could, based on superior water absorption for a given grammage product, justify a saving of around 50% in fibres. Consequently, the threshold for CO_2 emissions for structured tissue paper production is set slightly 50% higher (1850 kg CO_2/ADt instead of 1200 kg CO_2/ADt). The value of 1850 kg CO_2/ADt also respects the sum of the average specific CO_2 emissions provided for structural tissue paper machines (1500 kg) and the median emission from pulp production (350kg).

6. Criterion 2: Energy use

Graphic Paper /

The requirement is based on information on actual energy use during pulp and paper production in relation to specific reference values.

The energy consumption includes electricity and fuel consumption for heat production to be expressed in terms of points (P_{total}) as detailed below.

The total number of points ($P_{total} = P_E + P_F$) shall not exceed 2.5.

Table 2 contains the reference values for calculating the energy consumption.

In case of a mix of pulps, the reference value for electricity and fuel consumption for heat production shall be weighted according to the proportion of each pulp used (pulp '*i*' with respect to air dry tonne of pulp), and added together.

Criterion 2(a) Electricity

The electricity consumption related to pulp and paper production shall be expressed in terms of points (P_E) as detailed below.

Calculation for pulp production: For each pulp i used, the related electricity consumption ($E_{pulp,i}$ expressed in kWh/ADt) shall be calculated as follows:

$E_{pulp,i}$ = internally produced electricity + purchased electricity – sold electricity

Calculation for paper production: Similarly, the electricity consumption related to paper production (E_{paper}) shall be calculated as follows:

E_{paper} = internally produced electricity + purchased electricity – sold electricity

Finally, the points for pulp and paper production shall be combined to give the overall number of points (P_E) as follows:

$$P_E = \frac{\Sigma_{i=1}^{n} [pulp,i \times E_{pulp,i}] + E_{paper}}{\Sigma_{i=1}^{n} [pulp,i \times E_{ref\,pulp,i}] + E_{ref\,paper}}$$

In case of integrated mills, due to the difficulties in getting separate electricity figures for pulp and paper, if a combined figure is only available for pulp and paper production, the electricity values for pulp(s) shall be set to zero and the figure for the paper mill shall include both pulp and paper production.

Criterion 2(b) Fuel consumption for heat production

The fuel consumption related to pulp and paper production shall be expressed in terms of points (P_F) as detailed below.

Calculation for pulp production: For each pulp i used, the related fuel consumption ($F_{pulp,i}$ expressed in kWh/ADt) shall be calculated as follows:

$F_{pulp,i}$ = internally produced fuel + purchased fuel – sold fuel – 1.25 × internally produced electricity

Note:

1. $F_{pulp,i}$ (and its contribution to P_F, pulp) does not need to be calculated for mechanical pulp unless it is market air dried mechanical pulp containing at least 90 % dry matter.

2. The amount of fuel used to produce the sold heat shall be added to the term 'sold fuel' in the equation above.

Calculation for paper production: Similarly, the fuel consumption related to paper production ($F_{paper,}$ expressed in kWh/ADt) shall be calculated as follows:

F_{paper} = internally produced fuel + purchased fuel – sold fuel – 1.25 × internally produced electricity

Finally, the points for pulp and paper production shall be combined to give the overall number of points (PF) as follows:

$$P_F = \frac{\Sigma_{i=1}^{n} [pulp,i \times F_{pulp,i}] + F_{paper}}{\Sigma_{i=1}^{n} [pulp,i \times F_{ref\,pulp,i}] + F_{ref\,paper}}$$

Table 2. Reference values for electricity and fuel

Pulp grade	Fuel kWh/ADt $F_{reference}$		Electricity kWh/ADt $E_{reference}$	
	Non-admp	admp	Non-admp	admp
Chemical pulp	3 650	4 650	750	750
Thermomechanical pulp (TMP)	0	900	2 200	2 200
Groundwood pulp (including pressurised groundwood)	0	900	2 000	2 000
Chemithermomechanical pulp (CTMP)	0	800	1 800	1 800
Recycled pulp	350	1 350	600	600
Paper grade	kWh/tonne			
Uncoated fine paper, magazine paper (SC), newsprint paper	1 700		750	
Coated fine paper, coated magazine paper (LWC, MWC)	1 700		800	
admp = air dried market pulp				

Tissue Paper and Tissue Products

The requirement is based on information on actual energy use during pulp and paper production in relation to specific reference values.

The energy consumption includes electricity and fuel consumption for heat production to be expressed in terms of points (P_{total}) as detailed below.

The total number of points ($P_{total} = P_E + P_F$) shall not exceed 2.5.

Table 2 contains the reference values for calculating the energy consumption.

In case of a mix of pulps, the reference value for electricity and fuel consumption for heat production shall be weighted according to the proportion of each pulp used (pulp 'i' with respect to air dry tonne of pulp), and added together.

Criterion 2(a) Electricity

The electricity consumption related to pulp and paper production shall be expressed in terms of points (P_E) as detailed below.

Calculation for pulp production: For each pulp i used, the related electricity consumption ($_{Epulp,i}$ expressed in kWh/ADt) shall be calculated as follows:

$E_{pulp,i}$ = internally produced electricity + purchased electricity – sold electricity

Calculation for paper production: Similarly, the electricity consumption related to paper production (E_{paper}) shall be calculated as follows:

E_{paper} = internally produced electricity + purchased electricity – sold electricity

Finally, the points for pulp and paper production shall be combined to give the overall number of points (P_E) as follows:

$$P_E = \frac{\Sigma_{i=1}^{n} [pulp,i \times E_{pulp,i}] + E_{paper}}{\Sigma_{i=1}^{n} [pulp,i \times E_{ref\,pulp,i}] + E_{ref\,paper}}$$

In case of integrated mills, due to the difficulties in getting separate electricity figures for pulp and paper, if a combined figure is only available for pulp and paper production, the electricity values for pulp(s) shall be set to zero and the figure for the paper mill shall include both pulp and paper production.

Criterion 2(b) Fuel consumption for heat production

The fuel consumption related to pulp and paper production shall be expressed in terms of points (P_F) as detailed below.

Calculation for pulp production: For each pulp i used, the related fuel consumption ($F_{pulp,i}$ expressed in kWh/ADt) shall be calculated as follows:

$F_{pulp,i}$ = internally produced fuel + purchased fuel – sold fuel – 1.25 × internally produced electricity

Note:

1. $F_{pulp,i}$ (and its contribution to P_F, pulp) does not need to be calculated for mechanical pulp unless it is market air dried mechanical pulp containing at least 90 % dry matter.

2. The amount of fuel used to produce the sold heat shall be added to the term 'sold fuel' in the equation above.

Calculation for paper production: Similarly, the fuel consumption related to paper production ($F_{paper,}$ expressed in kWh/ADt) shall be calculated as follows:

F_{paper} = internally produced fuel + purchased fuel – sold fuel – 1.25 × internally produced electricity

Finally, the points for pulp and paper production shall be combined to give the overall number of points (PF) as follows:

$$P_F = \frac{\Sigma_{i=1}^{n} [pulp,i \times F_{pulp,i}] + F_{paper}}{\Sigma_{i=1}^{n} [pulp,i \times F_{ref\,pulp,i}] + F_{ref\,paper}}$$

Table 2. Reference values for electricity and fuel

Pulp grade	Fuel kWh/ADt $F_{reference}$		Electricity kWh/ADt $E_{reference}$	
	Non-admp	admp	Non-admp	admp
Chemical pulp	3 650	4 650	750	750
Thermomechanical pulp (TMP)	0	900	2 200	2 200
Groundwood pulp (including pressurised groundwood)	0	900	2 000	2 000
Chemithermomechanical pulp (CTMP)	0	800	1 800	1 800
Recycled pulp	350	1 350	700	700
Paper grade	kWh/tonne			
Tissue paper	1 950		950	
Structured tissue	3 000		1 500	
admp = air dried market pulp				

***Assessment and verification**: (for both (a) and (b)): The applicant shall provide detailed calculations showing compliance with this criterion, together with all related supporting documentation. Reported details shall therefore include the total*

electricity and fuel consumption.

The applicant shall calculate all energy inputs, divided into heat/fuels and electricity used during the production of pulp and paper, including the energy used in the de-inking of waste paper for the production of recycled pulp. Energy used in the transportation of raw materials, as well as in conversion and in packaging, is not included in the energy consumption calculations.

Total heat energy includes all purchased fuels. It also includes heat energy recovered by incinerating liquors and waste from on-site processes (e.g. wood waste, sawdust, liquors, waste paper, paper broke) as well as heat recovered from the internal generation of electricity. However, the applicant only needs to count 80 % of the heat energy from such sources when calculating the total heat energy.

Electric energy means net imported electricity coming from the grid and the internal generation of electricity measured as electric power. Electricity used for wastewater treatment does not need to be included.

Where steam is generated using electricity as the heat source, the heat value of the steam shall be calculated, then divided by 0.8 and added to the total fuel consumption.

In case of integrated mills, due to the difficulties in getting separate fuel (heat) figures for pulp and paper, if a combined figure is only available for pulp and paper production, the fuel (heat) values for pulp(s) shall be set to zero and the figure for the paper mill shall include both pulp and paper production.

6.1 Background

At the EU level, the pulp and paper industry accounts for approximately 12% of energy consumption but this can be much more significant in certain countries, such as Finland and Sweden, where it accounts for more than 50% of national energy consumption (ADEME, 2015). One interesting trend to observe is the relationship between total energy use and CO_2 emissions for the sector. The energy statistics published by DG Energy (2017), provide data for the pulp, paper and print sector for total energy consumption (normalised to tonnes of oil equivalent) and for CO_2 emissions (millions of tonnes).

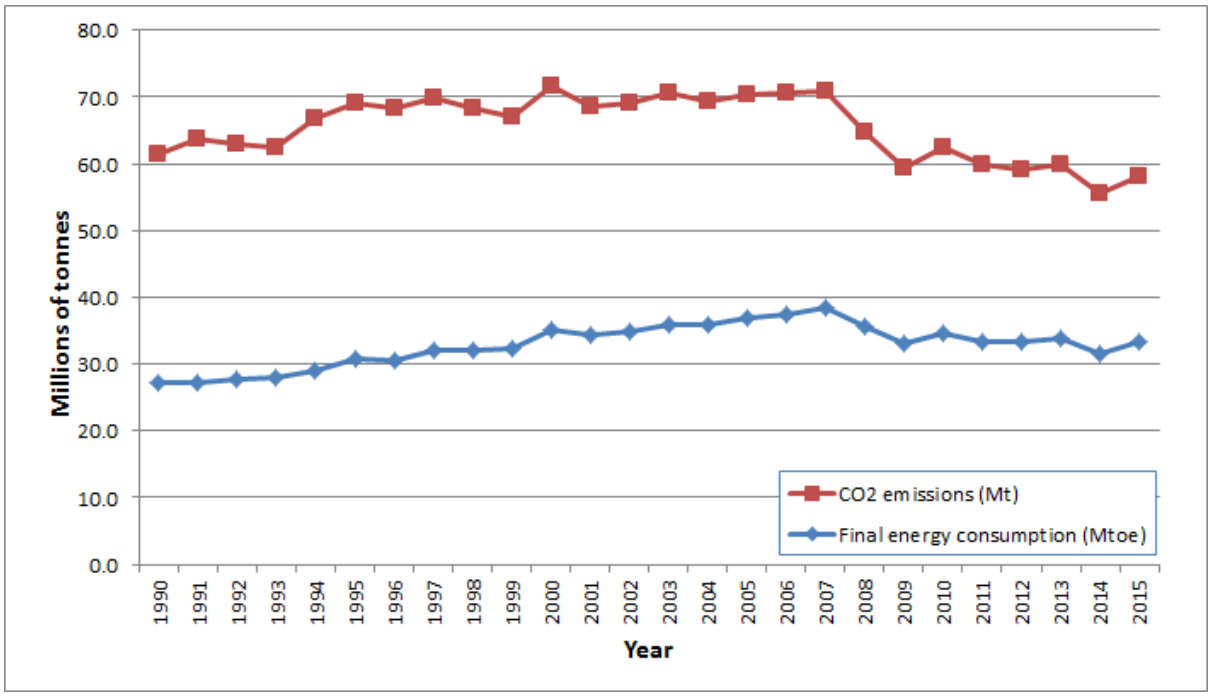


Figure 10. EU28 Energy Statistics: total energy consumption of paper, pulp and print (MTOE) related with CO_2 emission (Mt CO_2) (DG Energy, 2017).

From the data above, it can be seen that there was a steady relationship between total energy consumption and CO_2 emissions during the period of 1990 to 2007. Between 2007 and 2009 there was a sharp decrease in CO_2 emissions and a moderate decrease in total energy consumption. Since 2009 a steady relationship appears to have been re-established, but with a generally lower amount of CO_2 emissions per unit energy consumed in the sector. This shift to lower specific CO_2 emissions during the global economic crisis could be due to consolidation of existing mills, where the more energy efficient (and thus more competitive) mills continued to operate at slightly higher capacities while less efficient mills closed.

In general, the pulp and paper industry has a large potential for energy optimisation (Chen et al, 2012). The combustion of residual biomass (e.g. bark and black liquor) and the use of heat recovery units plays an important role in the overall energy efficiency of the pulp and paper industry. In Europe, the industry produces about 51 % of the electricity it consumes almost all of onsite generated electricity (95%) comes from combined heat and power installations (CHP). Overall, around 58% of fuel requirements for the industry are met using biomass (CEPI, 2016).

Energy costs represent a significant share of total production costs, so there is an inherent incentive for the pulp and paper sector to improve energy efficiency when

beginning new investment cycles. Fleiter et al., (2012) estimated energy to account for around 13% of total pulp and paper production costs. The pulp and paper sector is characterised by large scale, capital intensive plants and long investment cycles. Boilers and recovery boilers can have expected lifetimes of 30-40 years. This means that any radical shifts to technologies that offer improved energy efficiency is unlikely to occur on an industry-wide scale overnight, and that incremental improvements via upgrades are more likely.

Between 1990 and 2005, specific heat consumption improved towards a defined aggregate BAT level by a factor of approximately 10% (OECD/IEA, 2008). Specific electricity consumption (MWh/t) in CEPI countries has been reduced by 18.7% between 1990 and 2012 and by 8.6% between 2002 and 2012 (CEPI, 2013). Future trends for specific energy consumption in the pulp and paper industry are expected to show a continued decrease of between 0.5% and 1.0% each year until 2050 (DG Energy, 2013).

Monitoring of energy used in the pulp and paper industry is complex. Different processes will use primary energy in the form of fuel or secondary energy in the form of electricity and steam. Within one paper grade there are differences in raw material composition, product properties and installed process equipment, among others, that influence the overall energy consumption per product. Additionally, when comparing energy consumption data, one has to keep in mind that energy data recording and reporting is not yet uniform (Blum et al. 2007). When considering potential EU Ecolabel criteria for energy use, it is necessary to base justifications on energy data that are *technology specific.*

6.2. Methodology for reporting on energy consumption

The analysis of energy consumption requires the following sources of information:

- electricity consumption/production,
- steam consumption/production and
- fuel consumption.

It could be argued that there is no need to report steam consumption (unless steam is purchased from an external source nearby). Monitoring and reporting on steam is much more complex than monitoring fuel consumption over a one year period.

The proposed requirement is based on information on actual energy consumption in the form of fuel and electricity consumed to manufacture 1 tonne of product (sum of the energy from pulp processes and the paper machine). Fuel reference values have been set to account for all the energy sources required to meet the process heat demand while electricity reference values have been set to account for all the process power requirements.

Energy used in the transport of raw materials, as well as conversion and packaging, is not included in the energy consumption calculations. Electricity used for waste-water treatment and air cleaning need not be included.

Fuel

Fuel consumption accounting may be quite complex for certain processes (ie.g. Kraft pulp production) because fuel consumed may be:

- purchased from external sources as fuel;
- purchased from external sources as steam;
- produced internally (e.g. black liquor or waste from debarking).

Furthermore, some fuel, including internally produced fuel, may be sold to other companies or sites and some fuel may be consumed in CHP units, where not only heat is produced but also electricity.

The criterion refers to the calorific value of the fuel converted into heat - Fuel (heat) - and not of the steam produced from the fuel, therefore any purchased steam is to be converted back to fuel for the purposes of the EU Ecolabel calculation, using an assumed efficiency factor. To remove a possible misinterpretation the criterion title "*fuel*" has been altered to "*fuel consumption for heat production*". That in practice means that any electricity generated from fuel in a CHP unit can and should be subtracted from the fuel consumption calculation.

Any electricity generated by onsite fuel consumption is considered as internally produced electricity and should be subtracted from the total fuel consumption because otherwise there would be a double counting, once for fuel and once for internal electricity. When subtracting internal electricity, the electricity value (in kWh) is multiplied by 1.25 to account for a typical boiler efficiency of 80%.

The actual specific consumption rate of fuel is compared to reference values that have been developed for different pulp manufacturing techniques and paper machines and expressed as kWh/ADt.

If more than one pulp is used, the actual specific fuel consumption rate is calculated for one ADt of each pulp and then weighted depending on the fraction of each pulp in the mix. The weighted pulp value is then added to the actual specific fuel consumption rate for the paper machine. The same procedure is carried out for the reference values (i.e. weighted pulp average fuel energy reference value plus paper machine reference fuel energy value). Then it is simply the case of dividing the actual value by the reference value to produce a fuel score P_F.

Electricity

The accounting of electricity is much simpler than for fuel and is better metered as well. It is simply a case of adding on internally produced electricity to any purchased electricity and subtracting any sold electricity.

Exactly the same calculation procedure applies when calculating the correct reference specific electricity consumption value and the actual specific electricity consumption. Diving the actual value by the reference value produces a score, P_E.

Combined score

The previous criteria for Copying and Graphic Paper set separate values for PF and PE, where neither could exceed 1.5 times the reference value. However, in order to allow for flexibility when optimising mill energy systems, it was decided to simply set a single requirement of $\mathbf{P_E + P_F \leq 2.5}$. This approach was welcomed by industry stakeholders, who mentioned that some mills were showing increasing specific electricity consumption rates as processes are more and more automated and digitalised but that this was compensated by lower specific fuel consumption due to longer runs under carefully optimised conditions.

Comparison with data from literature

Care must be taken when considering other best practice specific energy consumption values for pulp and/or paper production.

For example for electricity, if the electricity balance of a non-integrated Kraft pulp mill is considered from a "*black box*" perspective, a modern plant could be considered as a net electricity exporter because (i) a lot of the wood raw material is converted into a high calorific value internal process waste (black liquor) and (ii) the black liquor and other process wastes like bark are burned in recovery boilers and CHP units that produce electricity. However, the EU Ecolabel approach considers how much electricity does the

process need, irrespective of whether it is produced internally or not. Consequently the actual specific electricity consumption can never be negative.

Analysis of the specific data for energy consumption from German pulp and paper mills (UBA, 2007) shows the possible scenario of reaching adequate overall energy performance of the plant (sum total of fuel and power) with the low specific electricity consumption but fuel consumption higher than the reference values. On the other side, stakeholder's consultation revealed the current industry trends towards higher electricity and lower fuel consumption due to the impact of climate change policies.

6.3. Energy consumption data collection and analysis

Data was collected via responses to a dedicated questionnaire about energy consumption data in pulp and paper production and via a review of the available literature.

The ranges of data for energy consumption received from questionnaire feedback are provided Table 11 and compared with the new reference values. Most feedback received was for chemical pulp or chemithermomechanical pulp (CTMP). Insufficient responses were received for other pulp types.

Table 11. Feedback on energy questionnaire for pulp and papermaking processes.

	Reported values (kWh/t)		Current EU Ecolabel reference values (kWh/t)	
	Electricity min-max	Heat min-max	Electricity	Fuel for heat (non-integrated)
Pulp production (chemical)	364-1056	1064-7636	750	3650 (4650)
CTMP	1305-1960	473-1142	1800	0 (800)
Paper Production				
Uncoated woodfree fine paper, magazine paper (SC)	520-760	553-3904	750	1700
Coated woodfree fine paper, coated magazine paper (LWC, MWC)			800	1700

Response to the questionnaire revealed a much wider range of heat data than electricity data. For example, the lowest and highest values for chemical pulp specific heat consumption varied by a factor of 7, but only varied by a factor of 3 for electricity. With the generally simpler system of a paper machine, values varied by a factor of 0.5 for electricity but by a factor of 7 for heat.

Due to uncertainties about any assumptions that respondents made when calculating the specific fuel and electricity consumptions, such as allocations, fuel heat values and whether or not the mill is integrated or not and so on, the responses can only be considered as an indication.

Data reported by UBA on specific power and heat consumption for different type of pulps is provided in Table 12 (UBA, 2009). Any losses or own consumption etc. of the energy conversion plant are not contained in the consumption values stated.

Table 12. Typical specific consumption values for process energy in pulp and paper mills (UBA, 2009)

Type of mill	Range of energy consumption	
	Power (kWh/t)	Heat (kWh/t)
Non-integrated Kraft pulp mill	700-800	3800-5100
Integrated uncoated mechanical paper	1200-1400	1000-1600
Integrated coated mechanical paper	1200-2100	1300-1800
Non-integrated uncoated wood free paper	600-800	1300-2500
Non-integrated coated wood – free paper	600-1000	1200-2100
RCF without deinking	300-700	1100-1800
RCF with deinking	900-1400	1000-1600
Non-integrated tissue (no TAD)	900-1200	1900-2800
RCF based tissue mills (no TAD)	800-2000	1900-2800

The data collected confirms the complexity and dynamic nature of energy consumption within the sector, resulting in difficulties to propose fixed reference values. Any particular mill might produce different product grades (or mixes of grades) and use different raw materials and technologies. Defining best practice is therefore not straightforward and requires certain assumptions to accommodate a series of possible scenarios.

In terms of product output, some mills only produce an intermediate pulp product, others only buy market pulp to produce paper (i.e. fully non-integrated production) while others produce both pulp and paper (integrated production) but may sell some of the excess pulp and purchase minor amounts of market pulp of other types to add as a furnish, allowing for the potential to adjust the technical properties of the paper they produce and/or to achieve a cost-optimal combination of ingoing and outgoing pulp.

In order to have a closer look at individual energy reference values, the Nordic Ecolabel reference values have been cross-checked and compared with the information contained in BREF (JRC, 2015) and other available sources (ÅF-Engineering AB, 2010, Ecofys 2009, Fleiter 2012; PAPRICAN 2008; Blum et al., 2007; UBA 2009).

6.3.1. Chemical pulp (Kraft and sulphite)

The manufacturing of bleached Kraft pulp consumes large amounts of heat energy (typically 10-14 GJ/ADt or 2778-3889 kWh/ADt) when excluding steam for the production of electrical power. Modern mills are energy efficient and energy recovery from the black liquor alone produces more than enough steam to satisfy the process heat requirements for the Kraft pulp mill. The lime kiln can be fired with bark powder or gasified bark, and remaining bark from the woodyard and chip screening stage can be combusted in a power boiler. Excess steam from the black liquor recovery boiler and power boilers is utilized in a condensing turbine to produce in green electricity, which is used for the process with any excess electricity being sold.

In cases of non-integrated pulp, heat energy is required to evaporate water from the pulp slurry so that it can be baled as a solid product (10% moisture) for transport to other paper mills. The heat energy consumed in this process is typically around 800 to 1000 kWh/ADt of market pulp. This corresponds to around 25 % of the total heat requirement for a Kraft pulp mill and 15 – 20 % of the electrical energy. Considering available data, it was decided to assume 1000 kWh/ADt of fuel consumption for pulp drying in non-integrated Kraft pulp mill.

The manufacturing of bleached sulphite pulp (Table 13) consumes about 7.5–16.5 GJ/ADt (2084-4583 KWh/ADt) of heat energy (excluding steam for the production of electrical power). The lower levels are achieved when paper pulp is produced and the drying of pulp is not included (pumpable pulp). The consumption of electrical energy is 550–900 kWh/ADt. If ozone is used in bleaching, the total consumption of electrical energy may reach 990 kWh/ADt.

Table 13. Indicative energy consumption levels for gross process heat and power for different types of sulphite pulp mills

Type of sulphite pulp mill	Indicative consumption level for gross process heat in kWh/ADt	Indicative consumption level for electricity in kWh/ADt	Remarks
Production of bleached sulphite or magnefite paper grade pulp (pumpable pulp)	2100 – 2400	400 – 700	Levels refer to manufacturing of pumpable pulp; pulp drying would additionally consume approx. 780–840 kWh/ADt heat and 100 kWh/ADt power
Production of bleached sulphite paper grade pulp (market pulp)	2900 – 3200	500 – 800	Levels refer to air dry pulp, i.e. include pulp dryer; if steam-consuming processes for by-products are included, energy consumption may increase accordingly
Production of bleached sulphite pulp for viscose	3200 – 3500	700 – 800	Levels refer to air dry pulp (including dryers) and include an ozone bleaching stage

**Note that 1 GJ = 277,78 kWh*

Comparative analysis of energy consumption values collected from different sources of information is presented below.

Table 14. Comparative energy consumption values for chemical pulp

	BREF, best performance mentioned		Nordic Ecolabel		Swedish mills, 2007		PAPRICAN 2008 (Median)		**Revised EU Ecolabel values**	
	Non-admp	admp	Non-admp	admp	Non-admp	admp	Non-admp	admp	**Non-admp**	**admp**
Bleached Kraft pulp										
Heat (kWh/ADt)	3530	4400	3750	4750	3542	4960	4500	5436	**3650**	**4650**
Electricity (kWh/ADt)	700	550	750	750	700	800	550	667	**750**	**750**
Bleached sulphite pulp										
Heat (kWh/ADt)	2250	3050	3750	4750					**3650**	**4650**
Electricity (kWh/ADt)	550	650	750	750		800			**750**	**750**

**admp means air-dried market pulp (i.e. non-integrated) and non-admp refers to integrated production.*

6.3.2 Mechanical and thermomechanical (TMP), and chemithermomechanical pulp (CTMP)

Electricity is the dominant type of energy used in the mechanical pulping process, thus this technology may have high or low CO_2 emissions, depending on the energy mix used to produce that electricity. Due to the large amount of waste heat produced, it is normal practice to integrate mechanical pulp production with paper machines, which need large amounts of heat energy to dry the paper sheets.

Groundwood pulp used for SC paper and newsprint production (i.e. Graphic Paper) consumes in total about 2200 kWh/t and 1600 kWh/t of electricity respectively, whereas TMP consumes about 3600 kWh/t and 2500 kWh/t for SC paper and newsprint respectively. However, higher heat recovery in TMP may normally lead to lower overall energy consumption than GW pulping in integrated processes. Some data from integrated German mills that produce mechanical pulp is provided below.

Table 15. Specific energy consumption of German integrated mechanical pulp mills (Blum et al., 2007).

Electric power (kWh/t)	Process heat (kWh/t)	Total energy (kWh/t)
2091	1306	3397
1217	1775	2992
1514	1626	3140
1375	1025	2400
n.a.	n.a.	2838
1197	1495	2695

The total energy consumption for the integrated German mills varies between 2400 and 3400 kWh/tonne. The specific electricity consumption accounted for 1197 to 2091 kWh/tonne, whereas process heat consumption for 1025 to 1775 kWh/tonne. Since these values are for integrated mechanical pulp mills, it is over limited assistance when trying to set separate energy reference values for the pulp production and paper production stages. It is necessary to establish reference values for market mechanical pulp especially in order to address the situations where minor amounts of mechanical pulp are added as furnish.

Stakeholder feedback about CTMP pulp mills revealed that almost all plants are integrated with paper machines except for some 10 non-integrated CTMP mills in Europe. Information received from license holders revealed that CTMP pulp specific energy consumption varied from 1305 to 1960 kWh/tonne for the electricity and 473-1142 kWh/tonne for heat. This numbers compare to 2300-3000 kWh/tonne for electricity and 0-300 kWh/tonne for heat reported in the BREF Document (JRC, 2015). Both ranges in from stakeholder feedback and the BREF add up to similar totals, but are split differently between heat and electricity. This highlights the difficulty of correctly interpreting data available in the literature when trying to justify separate reference values for pulp production and for paper production.

For TMP and CTMP recoverable energy fraction can amount to respectively 80% and 45% of power consumption and for TMP can exceed heat requirement for pulp drying or paper making. The following is prescribed in BAT 41: "*Extensive recovery of secondary heat from TMP and CTMP refiners and reuse of recovered steam in paper or pulp drying*" is considered a technique that applied in order to reduce the consumption of thermal and energy. Also, according to the BREF, heat recovery is "standard practice in all new and recently rebuilt plants" (only a few plants in Europe have not installed them).

Table 16 shows an example energy balance for heat and electricity in a Finnish non-integrated CTMP mill (JRC, 2015). The revised reference values for CTMP have been

based on this example given. Reporting the energy consumption as a sum of heat and power gives necessary flexibility to accommodate different scenarios, and also respond to the information received from license holders.

Table 16. Energy balance for a non-integrated Finnish CTMP mill

Department	*Heat (kWh/tonne)*	*Electrical power (kWh/tonne)*
Pulp mill		
Recovered steam, only for process used	+750	
External supply	0	+1650
Consumption	0	-1600
Effluent treatment	0	-50
Excess energy from pulp mill	+750	0
Pulp dryer		
Consumption	-1556	-150
Steam boiler (wood residual and fuel oil)	+806	+150
Total external supply	806	1800

Considering analysed energy consumption data and a lack of any major developments in the energy efficiency of mechanical pulp production, the new reference values for TMP and groundwood pulp have been aligned with the relevant energy reference values set out in Commission Decision 2012/448/EU for EU Ecolabel Newsprint Paper.

6.3.3 Recycled (RCF) pulp

RCF mills require substantial amounts of steam for heating of water, pulp, air and chemical additives as well as for drying paper sheets. Nevertheless, RCF pulping demands comparatively less total energy for processing than is needed for virgin pulp. In fact, it has been estimated that RCF Kraft pulp uses, on average, 33% less energy overall than Kraft mills using virgin raw material (Kinsela, 2012).

Energy consumption in RCF processing depends to a large extent on the design, type and amount of process steps involved to achieve a certain product quality or grade (see Table 17).

Table 17. Specific energy consumption for different RCF paper grades

	Packaging,paper	Newsprint	LWC/SC paper	Tissue paper and market pulp
Most commonly used Paper for Recycling (PfR) grades used.	Mixed PfR and boards and packaging from stores and supermarkets	Deinkable PfR (old newsprint and magazines)	Deinkable PfR (old newsprint and magazines)	Deinkable PfR (old newsprint and magazines); wood-free office PfR
Electricity consumption	150 – 250 kWh/t	300 – 420 kWh/t	400 – 600 kWh/t	400 – 500 kWh/t
Heat consumption (steam)	0 MJ/t (if dispersing is applied heating is required)	450 – 900 MJ/t (0.2 – 0.4 t_{steam}/t)	650 – 1 200 MJ/t (0.3 – 0.5 t_{steam}/t)	650 – 1 100 MJ/t (0.3 – 0.5 t_{steam}/t)

Whereas standard deinked stock for newsprint consumes about 300–350 kWh/t electrical energy, high-grade deinked pulp with higher ISO brightness (e.g. graphic papers) requires 400–500 kWh/t.

Integrated mills that make use of recycled fibre are often partially integrated, i.e. part of pulp is manufactured on site and the rest is purchased pulp (market pulp). The total

energy consumption when allocated to the final product is directly proportional to the share (% w/w) and type of pulp used in a mix. In Europe, nearly all RCF-based mills are integrated (or partially integrated). In RCF paper mills, steam is normally produced on site by each company. Electricity can also be purchased from the public grid.

During the consultation process, industry stakeholders clarified that RCF feedstock quality is a continually evolving phenomenon that depends on market features such as demand/availability of recovered paper grades, spot prices and wastepaper collection rates in different countries. The pulp and paper sector has to constantly adapt to fluctuations in recycled fibre quality. Demand for the best quality recycled fibres is extremely high. Data from German mills processing RCF is provided below.

Table 18. Specific energy consumption of German RCF mills with deinking (Blum et al., 2007)

Electric power (kWh/t)	Process heat (kWh/t)	Total energy (kWh/t)
927	1146	2073
1285	1113	1400
1430	1400	2830
1000	1600	2600
1377	2793	4170
758	1942	2700
1158	2589	3747

The German analysis included 20 RCF mills (13 without deinking and 7 with deinking) (Blum et al., 2007). The total energy consumption (heat and electricity) for the analysed mills varies between 1400 and 4170 kWh/tonne (electricity: 758-1430 kWh/tonne, heat: 1146-2793 kWh/tonne). Following the BREF findings (JRC, 2015), the indicative energy consumption levels for RCF pulps with deinking designated for Graphic Paper varies from 1000 to 1800 kWh/tonne for process heat consumption, and from 900 to 1300 kWh/tonne for electricity consumption. The ranges include all process units related to RCF processing and papermaking.

The use of lower grades of paper for recycling requires more energy for processing. In order to not discourage the potential for lower grades of PfR to be used as raw materials in EU Ecolabel products, it was argued that the Nordic reference electricity value (600 kWh) for DIP pulp was too low.

As an example, for newsprint based on 100% recycled fibres, values are given in **Table 19** for the specific energy consumption (SEC) and the energy balance.

Table 19. Specific energy consumption in an integrated RCF Swedish mill producing newsprints from deinked pulp.

Process unit	Process heat (kWh/ADt)	Electrical power (kWh/ADt)
Pulp mill		
Deinking	56	175
Washing and screening	0	50
Bleaching	0	75
Total pulp mill	56	300
Paper mill		
Stock preparation	0	235
Paper machine	1472	350
Total paper mill	1528	585
Effluent treatment	0	32
Pulp and paper mill		
Total	1528	917

The total (sum of heat and steam) best-practice energy consumption for graphic paper grade made of deinked RCF fibre requires approx. 3000 kWh/t (JRC, 2015; UBA, 2009). Considering the energy consumption required by a paper mill, it is proposed to update the reference values for RCF pulp manufacturing to 600 kWh/ADt for electricity consumption and 350 kWh/ADt for fuel consumption (1350 kWh/ADt for admp pulp). The values proposed are harmonised with the Nordic Ecolabel requirement.

RCF-based tissue paper

For integrated production the best practice energy consumption for RCF-based tissue pulp and paper mill was reported by Worrell as equal to 1944 kWh/ADt for fuel, and 1200 kWh/ADt for electricity (Worrell, 2007). Some other indication shows the average energy consumption for a traditional tissue plant at the level of around 2800-2900 kWh/tonne (TOSCOTEC, 2011).

For Nordic Ecolabel applications, where the tissue is produced from recycled fibre, fuel consumption is set at 500 kWh/tonne, and electricity at 500 kWh/tonne. Although not common practice, in cases where RCF pulp is dried and sold as market pulp, an extra 1000 kWh/tonne is added to the fuel consumption reference value (i.e. 1500 kWh/tonne) and an extra 200 kWh/tonne is added for electricity (i.e. 700 kWh/tonne).

The ambition level for RCF pulp has been set as a single electricity reference value (600 kWh/ADt) that should allow for deinked RCF to comply, even if it is being produced from lower grades of PfR that may have lower yields. To account for the generally higher quality requirements for Tissue Paper, an extra 100 kWh/ADt has been added for RCF pulp that is to be used in tissue paper production. Since the RCF pulp quality requirements generally impact more on electricity than on heat, no distinction is made between Graphic Paper and Tissue Paper for fuel reference values.

6.2.4. Paper mill

Graphic Paper production

The total electrical energy consumption of paper mills is summarised in Table 20. All electric power inside the paper mill building is included, i.e. all power usage inside the paper mill is included, starting from the pulp storage towers (in integrated mills) and ending at the finishing operations. The values are based on 100 % efficiency at the reel to make paper machines comparable.

An example of a modern non-integrated fine paper mill with on-line coating shows a total consumption of process heat of 1795 (kWh/t) and electric power of 829 (kWh/t) (JRC, 2015). Considering information found, it was proposed to harmonise the reference values for the paper grades with the Nordic Ecolabel requirements.

Table 20. Typical electrical energy consumption at modern paper mills based on the dimensioning capacity (= 100 % at reel) of the paper machine

Paper grade	*Power consumption in kWh/t* *(based on dimensioning capacity, Paper machine without stock preparation)*	*Power consumption in kWh/t* *(data refer to the whole paper mill)*
Newsprint	480 – 630	500 – 700
LWC paper	550 – 750	500 – 800
SC paper	600 – 700	450 – 700
Fine paper (uncoated)	450 – 650	450 – 650
Fine paper (coated)	600 – 850	600 – 750

The key differences in the design of paper making process are associated with the type and grade of paper produced. By far the largest share of energy consumed in a non-integrated paper mill is due to the drying section. The thermomechanical principles of the heat and mass transfer that occurs in the drying section of pulp and paper making process have remained almost unchanged since its initial development (contact drying with steam heated cylinders is still the dominant method for drying). Thermal drying is often responsible for more than 80% of the total steam use (Laurijssen et al., 2010). The average specific energy consumption per tonne of paper produced and per tonne of evaporated water is about 5800 MJ (about 1600 kWh) and 4000 MJ (about 1100 kWh), respectively (Culicchi, 2002).

Tissue paper production

The biggest difference between a paper machine that produces Tissue Paper and one that produces Graphic Paper is in the drying section. Tissue Paper production involves final drying in a large single stage heated roller (known as a Yankee cylinder) which rapidly brings the lower grammage Tissue Paper from a solids content of around 40 % to 90 %. The same drying operation for Graphic Paper is carried out using multiple heated rollers.

Even within Tissue Paper production, there are other distinctions that can be made in the paper machine, which are linked to how exactly the paper sheet should be dried at certain stages (i.e. conventional drying, Through Air Drying (TAD) and hybrid drying techniques).

The TAD technique results in a significantly higher specific energy consumption because a greater fraction of the total moisture content is removed via steam. The conventional process makes the most of the more energy efficient mechanical pressing to remove water. However, products dried using the TAD technique have different properties such as higher bulk and higher liquid absorption. This can translate into fibre savings at the level of the Tissue Paper base sheet or at the level of the Tissue Product (fewer plies needed for a given performance).

The previous EU Ecolabel criteria have been set based on energy consumption data for conventional Tissue Paper production. The Nordic Ecolabel set reference values for tissue paper machine consumption of fuel at 1800 kWh/tonne and for electricity at 1030 kWh/tonne. BREF indicates that the heat consumption for non-integrated tissue with conventional drying system is at 1800-2100 kWh/tonne, and for electricity 900-1100 kWh/tonne. According to Blum et al (2007), an example of best practice for a non-integrated tissue mill manufacturing handkerchiefs from 100% virgin fibre is 900 kWh/t for specific electricity consumption and 2000 kWh/t for specific heat consumption. The EU Ecolabel reference energy values for a tissue paper machine producing conventional tissue paper has been based on a similar level of ambition.

A breakdown of average specific energy consumption (SEC) for Tissue Paper production is shown on Figure 11.

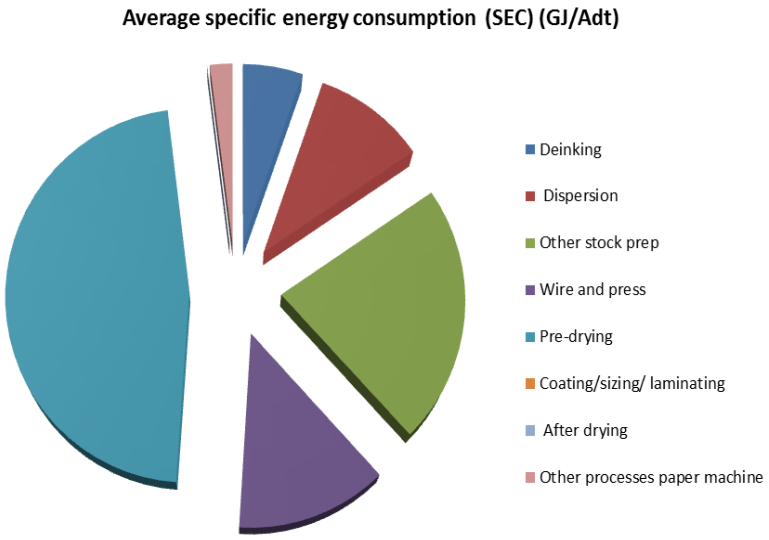


Figure 11. Average split of specific energy consumption for tissue paper making process (Laurijssen, 2013).

Tissue Paper Machine data analysis

It was possible to obtain energy consumption data for 36 tissue paper mills from across Europe during the stakeholder consultation exercise. The data includes tissue produced from virgin and recycled fibres. Three of the 36 sites produce "*structured tissue*" (i.e. used TAD or hybrid drying techniques).

For the conventional tissue making process the specific fuel (heat) consumption varied from 851 to 4274 kWh/ADt, and the specific electricity consumption varied from 443 to 2233 kWh/ADt. Total energy consumption varied from 1486 to 5255 kWh/ADt whereas total energy consumption for TAD technology varied from 4924 to 6175 kWh/ADt.

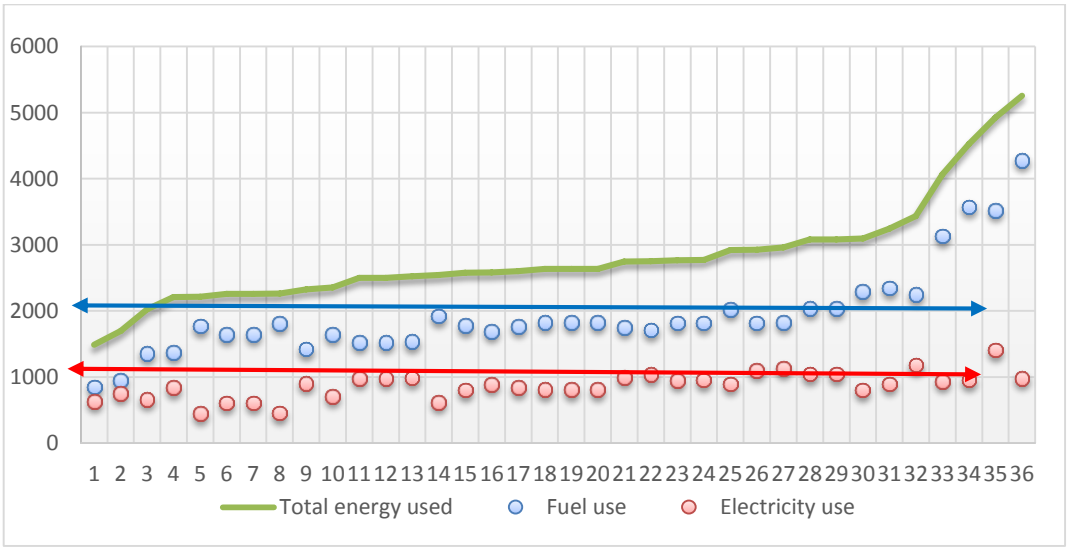


Figure 12. Energy consumption during manufacturing of the tissue paper grade- conventional process (kWh/tonne of paper)

The red and blue horizontal lines in Figure 12 represent the EU Ecolabel reference values for specific electricity and fuel consumption respectively. When contrasting the data in

Figure 12 with Table 12, it is possible to observe that the average reported correspond to the lower ranges of energy consumption for non-integrated tissue paper mill according to UBA (UBA, 2009). According to Laurijssen et al., (2010), typical heat demand just for the drying section was around 3.9 GJ (1100 kWh)/tonne paper and could be reduced to 2.7 GJ (750)/tonne paper in an optimised process. Accoridng to the same authors, drying typically accounted for around 50% of total energy demand in paper machines. According to the Ecofys study (2009) the average specific fuel consumption is 1527-2083 KWh/tonne.

Figure 13 shows the averaged values of energy consumption for different tissue making processes based on data provided by stakeholders.

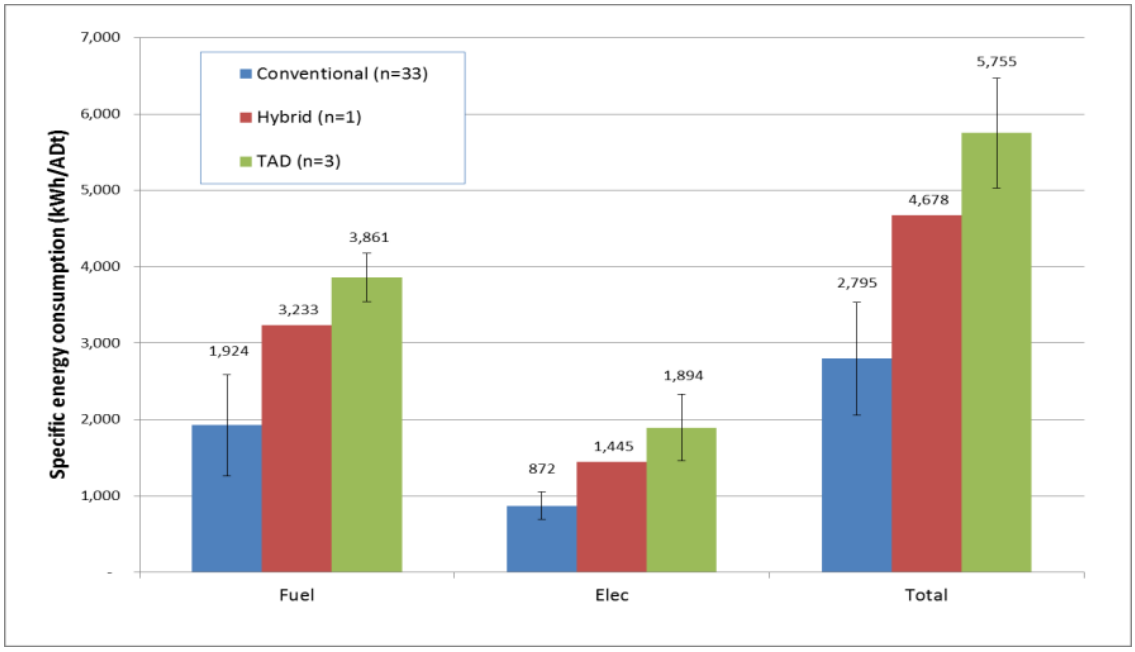


Figure 13. Energy consumption for different Tissue Paper making processes.

Following BREF findings, when applying energy-saving measures, the indicative energy consumption levels for the non-integrated tissue paper grade are 1800-2100 kWh/ADt for fuel, and 900-1000 kWh/ADt for electricity.

As previously mentioned, the production of "*structural tissue*" products may require significantly more heat energy but results in a higher quality product with significantly less fibre content in the product (due to fewer plies being needed for a given performance and a looser packing of fibres meaning a greater air void content in the sheet. Examples included a 50-80% increase in bulk enabling the roll diameter and firmness to be maintained, but to have lower sheet count in the roll, translating into a weight reduction of 20-25%. Other manufacturers reported fibre saving of 20-30 % when using TAD (Valmet, 2014) or hybrid machines (Voith, 2012). In fact some sample data provided to JRC shows that analysed TAD toilet paper and kitchen roll required up to 100% more energy (sum of fuel and electricity) providing fibre savings of 35% to 80%.

Given the growing market share and the fact that these are high quality and predominantly consumer facing Tissue Products and considering the potential for fibre savings, it was decided to incorporate a separate ambition level for energy reference values for "*structural tissue*" into the EU Ecolabel criteria. The ambition level for structure tissue has been targeted to be virtually unobtainable for TAD machines but to align with the more efficient hybrid machines.

A pre-requisite has been set for any tissue base paper that wishes to be considered against the higher energy reference values for structure tissue is that it must show a minimum water absorption of 10g water per g of unconverted Tissue Paper base sheet. Such a requirement should effectively exclude any possible abuse of the higher reference value by producers of multi-ply products made from convention Tissue Paper base sheets.

6.2.5. Summary of the reference sources for the proposed values

The summary of proposed revised reference values for the energy consumption, together with crossed-checked sources are summarized in Table 21.

Table 21. Final EU Ecolabel reference values for specific energy consumption.

Pulp grade	Fuel kWh/ADt $F_{reference}$		Electricity kWh/ADt $E_{reference}$		*Reference sources consulted.*
	Non-admp	admp	Non-admp	admp	
Chemical pulp	3650	4650	750	750	*BREF, ÅF-Engineering AB, 2010, PAPRICAN 2008, data collected, Nordic Ecolabel*
Thermomechanical pulp (TMP)	0	900	2 200	2200	*Nordic Ecolabel, UBA, BREF*
Groundwood pulp (including Pressurised Groundwood)	0	900	2 000	2 000	*Nordic Ecolabel, UBA, BREF*
Chemithermomechanical pulp (CTMP)	0	800	1800	1800	*Nordic Ecolabel, BREF, data collected*
RCF pulp (graphic)	350	1350	600	600	*UBA, BREF, Nordic Ecolabel*
RCF pulp (tissue)	350	1350	700	700	*UBA, BREF, Nordic Ecolabel, data collected*
Paper grade	Fuel kWh/tonne		ElectricitykWh/tonne		
Uncoated woodfree fine paper, newsprint paper,Magazine paper (SC)	1700		750		Nordic Ecolabel
Coated woodfree fine paper Coated magazine paper (LWC, MWC)	1700		800		Nordic Ecolabel
Tissue paper conventional	1950		950		BREF, data collected, UBA
Tissue paper structural	3000		1500		Data collected, BREF

**admp = air dried market pulp (indicative of non-integrated production)*

7. Criterion 3: Fibres – conserving resources, sustainable forest management

Graphic Paper / Tissue Paper and Tissue Products
The fibre raw material may consist of recycled fibres or virgin fibres. Any virgin fibres must not originate from GMO species. All fibres shall be covered by valid chain of custody certificates issued by an independent third-party certification scheme such as the Forest Stewardship Council (FSC), the Programme for the Endorsement of Forest Certification (PEFC) or equivalent, or be covered by delivery notes of paper for recycling in accordance with EN 643. At least 70 % of the fibre material allocated to the product or production line shall originate from forests or areas managed according to sustainable forestry management principles that meet the requirements set out by the relevant independent chain of custody scheme and/or originate from recycled materials. Excluded from the calculation of recycled fibre content is the reutilisation of waste materials that are capable of being reclaimed within the same process that generated them (i.e. paper machine broke — own produced or purchased). However, inputs of broke from conversion operations (own or purchased) may be considered as contributing towards the recycled fibre content if covered by EN 643 delivery notes. Any uncertified virgin material shall be covered by a verification system that ensures that it is legally sourced and meets any other requirement of the certification scheme with respect to uncertified material. The certification bodies issuing forest and/or chain of custody certificates shall be accredited or recognised by that certification scheme.
Assessment and verification: *The applicant shall provide the competent body with a declaration of compliance supported by a valid, independently certified chain of custody certificate from the manufacturer of EU Ecolabel graphic paper and for all virgin fibres used in the product or production line. FSC, PEFC or equivalent schemes shall be accepted as independent third-party certification. In case recycled fibre has been used and FSC or PEFC or equivalent recycled claims are not used, evidence shall be covered by EN 643 delivery notes.* *The applicant shall provide audited accounting documents that demonstrate that at least 70 % of the materials allocated to the product or production line originate from forests or areas managed according to sustainable forestry management principles that meet the requirements set out by the relevant independent chain of custody scheme and/or originate from recycled materials.* *If the product or production line includes uncertified virgin material, proof shall be provided that the content of uncertified virgin material does not exceed 30 % and is covered by a verification system that ensures that it is legally sourced and meets any other requirement of the certification scheme with respect to uncertified material.* *In case the certification scheme does not specifically require that all virgin material is sourced from non-GMO species, additional evidence shall be provided to demonstrate this.*

7.1. Supporting rationale

7.1.1. Sustainable Forest Management (SFM)

Sustainable forestry and widespread awareness of the adverse environmental impacts of deforestation originally came to the fore around 1990. Since then, a political commitment at the ministerial level in Europe to the definition, monitoring, understanding and promotion of sustainable forestry has become well established under the voluntary Forest Europe initiative, which 46 European countries have now signed up to, and which defines sustainable forest management as:

"The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems."

The above definition covers certain requirements relating to economic, environmental and social aspects and is quite complicated to translate into specific criteria that are

assessable and verifiable. A recent report published by the Commission (ENV, 2018) mentioned many different approaches to defining SFM by diverse organisations such as:

- Forest Europe and the EU Forest Strategy;
- the African Timber Organisation;
- the Dry-Zone Africa Process on Criteria and Indicators for SFM;
- the International Timber Organisation;
- the Forest Stewardship Council;
- the Lepaterique Process of Central America on Criteria and Indicators for SFM;
- the Montreal Process on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests;
- the Near East Process.
- the Pan-European Forest Process on Criteria and Indicators for SFM;
- the Programme for the Endorsement of Forest Certification;
- the Regional Initiative for the Development and Implementation of National Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia;
- the Tarapoto Proposal of Criteria and Indicators for Sustainability of the Amazon Forest;
- the UN Forum on Forests (UNFF);

The broad number of initiatives reflects the fact that it is difficult to define a standard set of criteria for SFM at the global level, due to the different regulatory systems, climate zones, tree species, soil types and ecosystems that exist. The same study (ENV, 2018) also describes a simplified approach to this issue of forest management (which focuses on reducing the risk of unsustainable deforestation rather than promoting or defining sustainable forest management) which has been provided in the recast Renewable Energy Directive (see COM/2016/0767 final/2 – 2016/0382). This simplified approach focuses on the environmental aspects, especially carbon stock balances, but does not address any specific aspects of economic or social impacts, which are the other two pillars of sustainability.

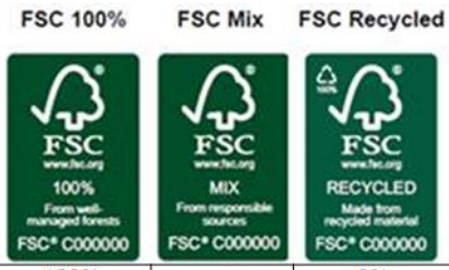
Feedback from EUEB members and industry stakeholders was overwhelmingly in favour of SFM assessment being audited and certified by independent, third party forestry experts. Competent Bodies assessing EU Ecolabel applications cannot realistically be expected to assess whether or not the forest from which the virgin raw material comes from complies with certain SFM principles or not.

Assessment of compliance with SFM principles of forests is one of the two fundamental aspects for this criterion in EU Ecolabel products. The second fundamental aspect is to be able to trace and allocate the movement of materials from SFM-certified forests (and recycled materials) through the supply chain and into the final product. As with SFM auditing, supply chain traceability should be audited by an independent third party. This would be a major task for any EU Ecolabel Competent Body to undertake, and would result in higher application fees being needed to cover the processing of licenses. .

The global leaders in chain of custody (CoC) certification are FSC and PEFC. The FSC CoC system tracks movements of certified FSC material, controlled material and recycled material. The PEFC CoC system tracks movements of certified PEFC material, controlled material and recycled material. Scope is made in the EU Ecolabel criterion for any other schemes that can be considered as "*equivalent*" to FSC or PEFC, although part of the recognition of such equivalency in criterion 3 must be approval of such a scheme by the EU Ecolabelling Board. This criterion was discussed at length by multiple stakeholders throughout the entire revision process. A range of opinions were expressed both about the ambition level and the precise formulation of the text. Some important points to highlight are:

- The ambition level has increased from 50% to 70%.

- Recycled fibres and virgin fibres from sustainably managed forests are considered as equivalent to each other in terms of complying with the 70% minimum.
- FSC certified sustainable virgin materials and PEFC certified sustainable virgin materials are considered as equivalent to each other in terms of complying with the 70% minimum.
- Any recycled materials must be covered by FSC-recycled claims, PEFC-recycled claims and/or EN 643 delivery notes.



Sustainable virgin	100%	70-100%	0%	70-100% (with a maximum of 84.99% recycled material)	70-100%
Post-consumer recycled	0%		100%		
Pre-consumer recycled					
Controlled		0-30%	0%	0-30%	0-30%

Figure 14. FSC and PEFC labels and related fibre input requirements for paper products

Consequently, the presence of an FSC or PEFC label on the product can be considered as automatic compliance with criterion 3. However, due to the fact that FSC do not recognise sustainable certified materials from PEFC as equivalent to FSC sustainable certified materials (instead they are considered as "*controlled material*") and the fact that PEFC do the same with FSC sustainable certified materials, it is possible that a hypothetical product, for example with:

- 35% FSC sustainable virgin material,
- 35% PEFC sustainable certified material and
- 30% FSC or PEFC controlled material,

Would not qualify for an FSC label or a PEFC label but would qualify for an EU Ecolabel. In these cases, it is important that the Competent Body is able to assess the inputs and outputs of all certified and controlled fibres in the production site during the last 12 months. A standard balance sheet is proposed to be made available to potential applicants, existing applicants and competent bodies via the User Manual. This balance sheet could also be used to declare inputs of any other raw materials in the future that the EUEB might agree to recognize as "equivalent to FSC or PEFC".

7.1.2. SFM certification at the European level

Considerable debate took place regarding the ambition level, A number of industry and Member State stakeholders were against increasing the ambition level while others argued that the increase was long overdue. In order to have as informed an argument as possible, the JRC examined certified forest levels in Europe and compared them to industrial Roundwood production. European forestry data is highly relevant since the fact the European paper industry consistently sources more than 80% of its virgin wood raw materials (i.e. industrial roundwood and chips) from Europe (CEPI 2010-2016).

In order to have an idea of the forest certification levels, and also to estimate the percentage of certified material produced in Europe, forest area data and industrial roundwood production data from Eurostat has been gathered and compared to forest certification data provided by FSC and PEFC.

Table 22. Relevant data for estimating forest certification and certified raw material availability in European countries.

Country (in descending order of % forest certification)	Forest available for wood supply (Mha)	Total FSC or PEFC certified (Mha)	% potentially productive forest that is certfied	Industrial roundwood production in 2014 (1000m^3 u.b)	% of EU28 roundwood production in selected countries	Assumed certified roundwood production in 2014 (1000m^3 u.b)
Croatia	1740	2039	117.2%	3078	1.0%	3078
Norway	8259	7416	89.8%	9807	3.0%	8806
Austria	3339	2984.6	89.4%	12030	3.7%	10753
Poland	8234	7320	88.9%	35425	10.9%	31493
Finland	19465	16695	85.8%	49202	15.2%	42200
Sweden	19832	16610	83.8%	64200	19.8%	53770
Czech Republic	2301	1799	78.2%	13365	4.1%	10449
Estonia	1994	1535	77.0%	5769	1.8%	4441
Slovakia	1785	1286	72.0%	No data	0.0%	0
Ireland	632	447	70.7%	2625	0.8%	1857
Germany	10888	7638	70.2%	43243	13.4%	30335
Latvia	3151	1848	58.6%	11298	3.5%	6626
Lithuania	1924	1090	56.7%	5035	1.6%	2852
Netherlands	301	170	56.5%	980	0.3%	553
Romania	4627	2597	56.1%	10484	3.2%	5884
UK	3144	1644	52.3%	9361	2.9%	4895
France	16018	8207	51.2%	24451	7.6%	12528
Luxembourg	86	42	48.8%	No data	0.0%	0
Bulgaria	2213	1079	48.8%	3036	0.9%	1480
Denmark	572	269	47.0%	1230	0.4%	578
Belgium	670	302	45.1%	No data	0.0%	0
Slovenia	1139	300	26.3%	3511	1.1%	925
Spain	14711	3611	24.5%	12476	3.9%	3062
Portugal	2088	382	18.3%	No data	0.0%	0
Hungary	1779	304	17.1%	3095	1.0%	529
Italy	8216	821	10.0%	No data	0.0%	0
Cyprus	41	0	0.0%	4	0.0%	0
Greece	3595	0	0.0%	No data	0.0%	0
TOTAL	**142744**	**88435.6**	**62.0%**	**323705**	**100.0%**	**237094**

It is important to note that the estimated areas of certified forests already discounts double counting for areas that are certified by both FSC and PEFC. This was possible thanks to the joint statement released by FSC and PEFC titled "*Double certification FSC and PEFC – estimation end 2016*". The FSC data (July 2017) and PEFC data (March 2017) were used.

The forest area available for wood supply (i.e. productive forests) is always lower than the total forest and wooded areas reported in Eurostat. A comparison of these numbers is available in Table 6.1 (page 167) of the 2016 Edition of "*Agriculture, forestry and fishery statistics*" published by Eurostat (Eurostat, 2016).

The data for industrial roundwood production was also taken from the same Eurostat report. It is understood that industrial roundwood may be used in the production of sawnwood, veneers and pulp and paper production. In order for an estimation of the availability of certified raw material produced in Europe that is used in pulp and paper production to be made, the following assumptions had to be made:

- That there is no preferential destination for certified industrial roundwood material between the sawnwood, veneer and pulp sectors.
- That certified and non-certified forests in a given country are equally productive.
- That all certified forests are also productive forests.

From the data in Table 22, it is clear that there is a discrepancy in the reporting for Croatia, either an overestimation of certified forest or an underestimation of forest available for wood supply or a combination of both. Fortunately Croatia only accounted for a very small share (1.0%) of total EU28 industrial Roundwood production, so any errors for that Member State do not have a major impact on overall data.

There is a clear difference in certification levels in different countries. However, it is important to consider certification levels in absolute terms, i.e. the total productive forest area (which may be large or small) and not just the percentage of the total area certified. Weighting for the total productive forest areas in each Member State, it was estimated that approximately **62.0%** of all productive forest area in Europe is FSC or PEFC certified.

If actual industrial roundwood is also factored into the calculation, the estimated certified industrial roundwood rises to **73.2%**. The reason for this value being higher than the 62.0% certified forest area is at least partly due to:

- The fact that the countries with the most intensive production have higher certified forest percentages than 62% (e.g. Sweden with 19.8% of production and 83.8% certification; Finland with 15.2% of production and 85.8% certification; Poland with 10.9% of production and 88.9% certification and Germany with 13.4% of production and 70.2% certification).
- The fact that countries with the lowest percentages of forest certification tended to not have significant roundwood production rates (Spain was the only country accounting for more than 1.1% of European roundwood production that had less than 50% of its productive forests certified).

The figures of 62.0% (certified forest area) and 73.2% (certified production estimation) are close to the figure of 64.6% certified wood, chips and sawmilling by-products delivered to European mills that was quoted by CEPI in their 2013 Sustainability Report. These three figures, 62.0%, 64.6% and 73.2% should therefore be considered when discussing the basic ambition level for any requirements relating to sustainable certified virgin materials in the EU.

7.1.3. Recycled fibres: the other type of sustainable fibre

Paper recycling rates have improved dramatically all over the world in the last 20 years as the original technological challenges with deinking and paper machine optimisation have been overcome. Apart from the environmental benefits that have been attributed to paper made from recycled fibre (e.g. lower energy consumption, lower water consumption, less pressure on forest resources etc. (UBA, 2012) paper recycling is an economically viable business in its own right.

Statistics on Paper for Recycling (PfR) and recycled fibres

In the CEPI 2013 Sustainability Report (CEPI, 2013), a material flow for the European paper recycling loop shows that the input of virgin fibre was 46Mt while the input of PfR was 49Mt. However, it should be noted that this loop will also include paper grades that are not included in the scope for graphic or tissue paper but have typically high recycled fibre contents (e.g. packaging grades).

For a better understanding of the flows of PfR into graphic and tissue paper grades, it is useful to refer to the annually reported CEPI statistics. Overall trends in the recycling rate in Europe have been calculated by dividing the total quantities of PfR going into mills by the total quantities of paper and board coming out of those same mills.

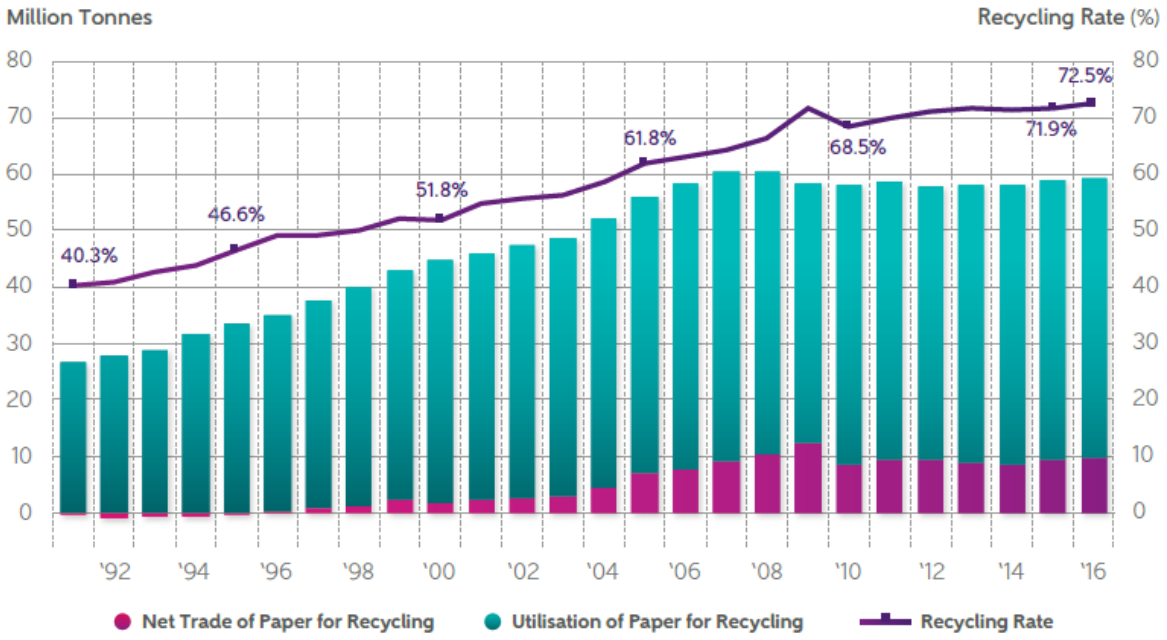


Figure 15. Trends in paper recycling rates in EU28 + Norway and Switzerland (CEPI, 2016).

The data in Figure 15 show that major progress has been made in the recycling rate of paper between the years 1991 and 2011. Since 2011, rates have plateaued at around 71-72%. It is also apparent that net exports of PfR (mainly to China) increased notably between 1999 and 2009 before stabilising at around 10 million tonnes per year (around 10% of annual paper and board consumption).

Significant further increases in recycling rates are not expected due to a combination of certain paper products being used in such a way that prevents their recycling (e.g. toilet paper) and limitations due to sub-optimal post-consumer collection and sorting of waste paper. However, a target of 74% has been set for 2020, which might only be achieved with the aid of other legislative measures such as the banning of the landfill disposal of paper and a shift away from the commingled collection of paper with other materials (EPRC, 2017).

Why no minimum mandatory content for recycled fibres?

No mandatory minimum requirement for recycled fibre content was set due to opposition by certain Member State representatives and industry stakeholders, citing that such a requirement would favour some regions (i.e. paper producers in areas with large population centres and thus locally available Paper for Recycling) over others. These arguments make sense if current industry practice is considered.

The pulping of PfR (with or without deinking) results in the production of RCF pulp, which in turn constitutes the basis for any recycled content claim in paper products. According to CEPI statistics (CEPI 2016), trade in deinked market pulp (i.e. deinked RCF pulp) was around 40,000 tonnes in a market where over 47,000,000 tonnes of Paper for Recycling is moving. Even accounting for losses of PfR in the RCF pulp process, it can be safely assumed that the vast majority of PfR is consumed in integrated mills.

For any integrated mill (whether it is based on virgin or recycled raw material) it makes economic sense for them to be located close to stable sources of the main raw material (i.e. forests or PfR). The local or regional availability of PfR is strongly dependent on the size of local or regional population centres and the recycling infrastructure in place. According to CPI Statistics (CEPI 2016) for pulp production, there is a clear split as follows:

- The Member States with the highest share of the use of PfR in the EU28 tend to be those with the highest populations e.g. Germany (35%), France (11%), Spain (11%) and Italy (10%).
- The Member States with low population densities and high areas of forest (i.e. Sweden 31% and Finland 29%) dominate total pulp production.

Due to the fact that Sweden and Finland dominate total pulp production in the EU28 but account for only a small amount of any PfR consumption, it is clear that any mandatory minimum requirement for recycled content would discriminate against Sweden and Finland and send a signal that if they want the EU Ecolabel for their products, they should use less raw wood from local and sustainably managed forests and instead import PfR from other regions. The same situation could potentially apply to other integrated mills set up near sustainably managed forests throughout Europe as well.

To prevent this situation from arising, the EU Ecolabel criteria consider recycled fibres as equivalent to sustainable certified virgin fibres. This reflects approaches already taken by the FSC and PEFC labelling rules and with recently voted Commission Decisions for other wood-based product groups.

The distinction between "paper machine broke" and "converting broke"

The previous fibre criteria for Copying and Graphic Paper and for Newsprint Paper made reference to the term "*mill broke*", which should be excluded from any calculations of inputs of recycled material to the paper production process. This logic stemmed from the ISO 14021 logic that waste that can be reincorporated into the same process that generated it should not be considered as recycled material.

Industry stakeholders flagged up concern about this term because the term "*paper mill*" refers to any site that contains at least one paper machine. It is possible that the paper mill might also contain converting lines as well. In such cases, any broke from the paper machine and any broke from the converting lines could be argued to both fall under the common term "*mill broke*".

Clarity was therefore needed about where exactly the paper making process ends and the conversion operation begins, because the standard practice is that these are considered as distinct processes. Industry feedback stated that any broke produced before slitting and winding of the paper reel should be considered as "*paper machine broke*" and that any broke from subsequent operations in converting lines, whether at the same site where the reel was produced or at another site, should be considered as "*broke from conversion operations*".

The European standard for classifying and recording the production and movement of Paper for Recycling (PfR) is EN 643 (CEPI 2013b). There are many different grades of PfR defined in the standard, but no code is provided for paper machine broke. However, all different types of converting broke do have an EN 643 code. Consequently, it was deemed appropriate that any inputs of converting broke, if they are to be considered as recycled materials, need to be covered by EN 643 delivery notes.

These delivery notes are equally applicable whether the material is transferred within the same site, transferred to another site operated by the same company or sold to another company operating at a different site.

8. Criterion 4: Restricted hazardous substances and mixtures

Criterion 4 is split into a number of sub-criteria as follows:

- Horizontal criteria that are linked to Articles 6(6) and 6(7) of the EU Ecolabel Regulation, which are based on hazard classifications rather than specific substances and which remain the final product ≥0.10% w/w (i.e. 4a and 4b).
- Specific criteria that refer to individual substances or groups of chemicals which apply at the level of the purchased chemical (e.g. criteria 4c, 4d, 4e, 4f, etc.).

While the vast majority of the criteria are identical for Annex I (Graphic Paper) and Annex II (Tissue Paper and Tissue Products) there are some differences, which are summarised as follows:

- The derogations from criterion 4b) are different due to the different types of chemicals that may be used in Graphic Paper and Tissue Paper production.
- Screening for the non-use of APEOs includes coating chemicals for Graphic Paper but not for Tissue Paper and Tissue Products, because the latter do not use coating chemicals.
- The restriction on copper-based pigments and dyes and copper impurities in dye-stuffs is not applied to Tissue Paper and Tissue Products due to the importance of certain commercially standardised copper-based blues used in Tissue Products.
- There is a specific restriction for lotions in Tissue Products that is not applicable to Graphic Paper.

A common preamble has been inserted for the horizontal hazardous substance restrictions – stating that the basis of assessing and verifying compliance with the criteria should be Safety Data Sheets (SDSs) and declarations from chemical suppliers. This is to reduce the risk of possible misinterpretation of the legal text in terms of what level of detail it is necessary to determine the hazard classifications of the substances and mixtures in chemicals used.

Graphic paper / Tissue and tissue product
The basis for demonstrating compliance with each of the sub-criteria under criterion 4 shall be the applicant providing a list of all the relevant chemicals used together with appropriate documentation (safety data sheet or a declaration from the chemical supplier).

8.1 Horizontal hazardous substance and mixture restrictions

8.1.1. Criterion 4(a) Restrictions on Substances of Very High Concern (SVHC)

Graphic paper / Tissue Paper and Tissue Products
Note: All process and functional chemicals used in the paper mill must be screened. This criterion does not apply to chemicals used for wastewater treatment unless the treated wastewater is recirculated back into the paper production process. The paper product shall not contain substances that have been identified according to the procedure described in Article 59(1) of Regulation (EC) No 1907/2006 and included in the Candidate List for Substances of Very High Concern in concentrations greater than 0.10 % (weight by weight). No derogation from this requirement shall be granted.
Assessment and verification: *The applicant shall provide a declaration that the paper product does not contain any SVHC in concentrations greater than 0.10 % (weight by weight). The declaration shall be supported by safety data sheets or appropriate declarations from chemical suppliers of all process and functional chemicals used in the paper mill that show that none of the chemicals contain SVHC in concentrations greater than 0.10 % (weight by weight).* *The list of substances identified as SVHC and included in the candidate list in accordance with Article 59(1) of Regulation (EC) No 1907/2006 can be found here:* *http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp.* *Reference to the list shall be made on the date of application.*

8.1.2. Criterion 4(b) Classification, Labelling and Packaging (CLP) restrictions

Graphic Paper
Note: All process and functional chemicals used in the paper mill must be screened. This criterion does not apply to chemicals used for wastewater treatment unless the treated wastewater is recirculated back into the paper production process. Unless derogated in Table 3, the paper product shall not contain substances or mixtures in concentrations greater than 0.10 % (weight by weight) that are classified with any of the following hazard statements in accordance with Regulation (EC) No 1272/2008: **- Group 1 hazards**: Category 1A or 1B carcinogenic, mutagenic and/or toxic for reproduction (CMR): H340, H350, H350i, H360, H360F, H360D, H360FD, H360Fd, H360Df. **- Group 2 hazards**: Category 2 CMR: H341, H351, H361, H361f, H361d, H361fd, H362; Category 1 aquatic toxicity: H400, H410; Category 1 and 2 acute toxicity: H300, H310, H330; Category 1 aspiration toxicity: H304; Category 1 specific target organ toxicity (STOT): H370, H372, Category 1 skin sensitiser H317*. **- Group 3 hazards**: Category 2, 3 and 4 aquatic toxicity: H411, H412, H413; Category 3 acute toxicity: H301, H311, H331; Category 2 STOT: H371, H373. *H317 restrictions shall only apply to commercial dye formulations, surface finishing agents and coating materials applied to paper. The use of substances or mixtures that are chemically modified during the paper production process (e.g. inorganic flocculating agents, cross-linking agents, inorganic oxidising and reducing agents) so that any relevant restricted CLP hazard no longer applies shall be exempted from the above requirement. **Table 3. Derogations to the CLP hazard restrictions and applicable conditions**

Substance / mixture type	Applicability	Derogated classification(s)	Derogation conditions
Dyes and pigments	Used in wet end or surface application during the production of coloured paper.	H411, H412, H413	The chemical supplier shall declare that a fixation rate of 98 % can be achieved on the paper and provide instructions about how this can be ensured.

Basic dyes	Dyeing of paper based mainly on mechanical pulp and/or unbleached chemical pulp.	H400, H410, H411, H412, H413, H317	The paper producer shall provide a declaration of compliance with any relevant instructions.
Cationic polymers (including polyethyleneimines, polyamides and polyamines)	Various uses possible, which include use as retention aids, improve wet-web strength, dry strength and wet strength.	H411, H412, H413	The paper producer shall provide a declaration of compliance with any relevant instructions for safe handling and dosing specified in the safety data sheet.

Tissue Paper and Tissue Products

Note: All process and functional chemicals used in the paper mill and, where relevant, during the tissue paper conversion process must be screened. This criterion does not apply to chemicals used for wastewater treatment unless the treated wastewater is recirculated back into the paper production process.

Unless derogated in Table 3, the paper product shall not contain substances or mixtures in concentrations greater than 0.10 % (weight by weight) that are classified with any of the following hazard statements in accordance with Regulation (EC) No 1272/2008:

- **Group 1 hazards**: Category 1A or 1B carcinogenic, mutagenic and/or toxic for reproduction (CMR): H340, H350, H350i, H360, H360F, H360D, H360FD, H360Fd, H360Df.

- **Group 2 hazards**: Category 2 CMR: H341, H351, H361, H361f, H361d, H361fd, H362; Category 1 aquatic toxicity: H400, H410; Category 1 and 2 acute toxicity: H300, H310, H330; Category 1 aspiration toxicity: H304; Category 1 specific target organ toxicity (STOT): H370, H372, Category 1 skin sensitiser: H317*.

- **Group 3 hazards**: Category 2, 3 and 4 aquatic toxicity: H411, H412, H413; Category 3 acute toxicity: H301, H311, H331; Category 2 STOT: H371, H373.

**H317 restrictions shall only apply to commercial dye formulations, surface finishing agents and coating materials applied to paper.*

The use of substances or mixtures that are chemically modified during the paper production process (e.g. inorganic flocculating agents, cross-linking agents, inorganic oxidising and reducing agents) so that any relevant restricted CLP hazard no longer applies shall be exempted from the above requirement.

Table 3. Derogations to the CLP hazard restrictions and applicable conditions

Substance / mixture type	Applicability	Derogated classification(s)	Derogation conditions
Dyes and pigments	Used in wet end or surface application during the production of coloured paper.	H411, H412, H413	The chemical supplier shall declare that a fixation rate of 98 % can be achieved on the paper and provide instructions about how this can be ensured. The paper producer shall provide a declaration of compliance with any relevant instructions.
Polyamidoamine-epichlorohydrin (PAE)-based wet strength agents	Used as retention agents to improve runnability or to impart wet strength to the product.	H411, H412, H413	The combined residual monomer content of epichlorohydrin (ECH, CAS No 106-89-8) and its breakdown products 1.3-dichloro-2-propanol (DCP, CAS No 96-23-1) and 3-monochloro-1.2-propanediol (MCPD, CAS No 96-24-2) must not exceed 0.35 % (w/w) of the active solids content of the formulation.
Glyoxal (recycled fibre)	Impurity in recycled fibres.	H341, H317	Only permitted in concentrations exceeding 0.10 % (w/w) if due to contaminants from recycled materials used in the papermaking process. In such cases, compliance with the limit defined in criterion 6c) must be demonstrated.
Polyamidoamine-epichlorohydrin (PAE)-based Yankee auxiliary chemicals	Used as creping aids.	H411, H412, H413	The combined residual monomer content of epichlorohydrin (ECH, CAS No 106-89-8) and its breakdown products 1,3-dichloro-2-propanol (DCP, CAS No 96-23-1) and 3-monochloro-1,2-propanediol (MCPD, CAS No 96-24-2) must not exceed 0.05 % (w/w) of the

			active solids content of the formulation.
Cationic polymers (including polyethyleneimines, polyamides and polyamines)	Various uses possible, which include use as retention aids, improve wet-web strength, dry strength and wet strength.	H411, H412, H413	The paper producer shall provide a declaration of compliance with any relevant instructions for safe handling and dosing specified in the safety data sheet.

Assessment and verification: *The applicant shall provide a list of all relevant chemicals used together with the relevant safety data sheet or supplier declaration.*

Any chemicals containing substances or mixtures with restricted CLP classifications shall be highlighted. The approximate dosing rate of the chemical, together with the concentration of the restricted substance or mixture in that chemical (as provided in the safety data sheet or supplier declaration) and an assumed retention factor of 100 %, shall be used to estimate the quantity of the restricted substance or mixture remaining in the final product.

Justifications for any deviation from a retention factor of 100 % or for chemical modification of a restricted hazardous substance or mixture must be provided in writing to the competent body.

For any restricted substances or mixtures that exceed 0.10 % (weight by weight) of the final paper product but are derogated, proof of compliance with the relevant derogation conditions must be provided.

8.1.3. Rationale for criteria 4(a) and 4(b)

The general structure of the horizontal hazardous substance criteria (preamble, horizontal SVHC restrictions and horizontal CLP restrictions) follows the general recommendations of the 1st and 2nd EU Ecolabel Chemicals Task Forces.

The scope of the horizontal criteria (4a and 4b) applies to any process chemicals or functional chemicals used in the paper machine or, in the case of tissue products, during conversion. This is a change from the previous horizontal approach, which in principle also applied to chemicals used during pulp production.

It was generally acknowledged that attempts to apply the horizontal hazardous substance screening approach to pulp chemicals would result in major administrative burdens. When asked, stakeholders did not identify any individual hazardous substances with any restricted CLP classification present in pulp that could actually remain in the final paper product in quantities exceeding 0.1% w/w.

The scope for Graphic Paper for criteria 4a and 4b was narrowed to chemicals used in the paper machine, conversion was not included because the conversion of any Graphic Paper would lead to it falling under the scope of another EU Ecolabel product group, either Printed Paper or Converted Paper. With Tissue Paper and Tissue Products, the scope of criteria 4a) and 4b) is extended to include the conversion process, because conversion is included within the scope for Tissue Products.

Broadly speaking, the types of chemicals used can be split into 3 groups:

- ***Commodity chemicals:*** chemicals that are traded in large quantities worldwide and which are highly relevant to the pulp and paper industry. Examples include chlorine dioxide, hydrogen peroxide, sodium salts and sulfuric acid.
- ***Process chemicals:*** chemicals that are used to optimise process conditions, such as improving the runnability and speed of paper machines, reducing fouling and reducing steam consumption. Examples include retention aids, defoamers, fixative agents and biocides.
- ***Functional chemicals:*** chemicals that directly influence certain physical qualities of the paper such as strength, brightness or water repellency and which will affect the printability of the paper. Examples of functional chemicals include dyes, coating pigments, china clay, calcium carbonate, binders, wet strength agents and sizing additives.

Commodity chemicals (such as chlorine dioxide, hydrogen peroxide, sodium salts, sulphuric acid etc.) can be screened out because they are highly reactive in aqueous environments and clearly undergo chemical modification to the extent that they do not remain in the final paper product.

Some chemicals carry out more than one function and there is no concrete boundary between process chemicals and functional chemicals. However, in terms of volumes used, functional chemicals are much more significant than process chemicals (Bajpai, 2015). Each process chemical or functional chemical should be assessed as detailed below.

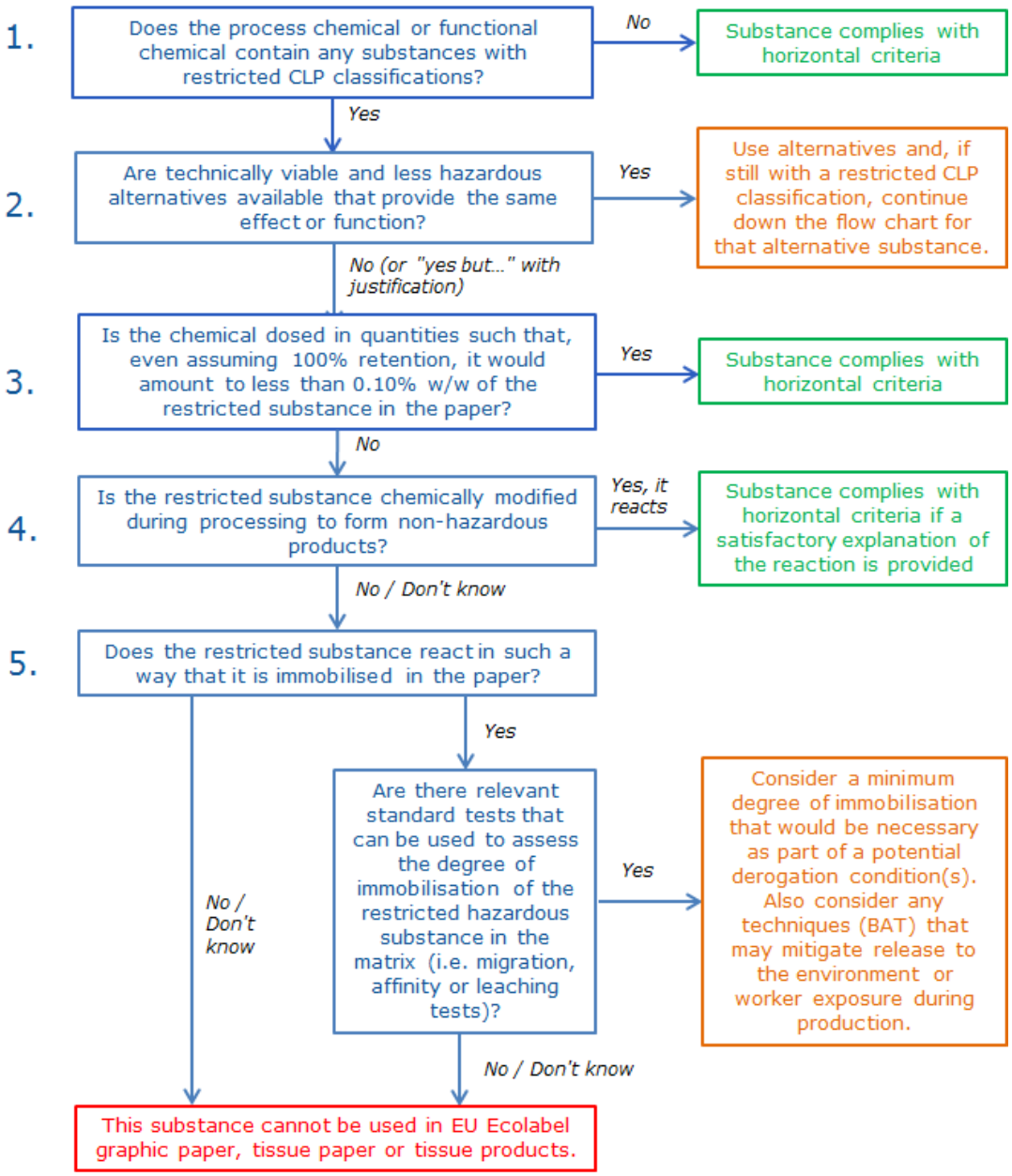


Figure 16. Illustration of the horizontal approach for hazardous substance and mixture criteria in EU Ecolabel paper products.

The general approach above should be followed for criterion 4b. The same approach also applies for SVHCs but with the one difference that no derogations can be made for SVHCs (i.e. step 5 is not an option).

The basis for all information related to criteria 4a and 4b should be a REACH compliant Safety Data Sheet (SDS). If a hazardous substance is present in a supplied mixture above a certain trigger concentration that is related to the hazards it presents, it must be listed in Section 3 of the SDS.

When the SDS reveals the presence of restricted hazardous substances, its use has to be quantified by estimating the total quantity of the substance added and dividing this by the total production volume of the EU Ecolabel product. This will provide a final product concentration that assumes that all the added substance remains in the final product and none of it reacts to form different products. This initial assumption can then be multiplied by factors that account for degrees of chemical reaction and any losses due to washing out of substances or so on.

Proposals were made to have limits higher than 0.10% w/w permitted for Group 3 hazards, based on the fact that they are less hazardous than substances with Group 1 or Group 2 classifications. However despite this reasonable logic, this proposal was rejected because it would not be in line with the approaches taken in all other EU Ecolabel product groups or the recommendations of the 1st Chemicals Task Force.

The general exemption clause for substances undergoing chemical modification needs to be better explained in order to minimise confusion and improve the consistency of interpretation of the horizontal chemical criteria.

8.1.3.1. How to define chemical modification in the paper production process?

Unfortunately, it is not possible to provide an exhaustive, all-encompassing definition of chemical modification. A good example is the case of dyes. The dye colour is very much present in the final product and the way in which light is absorbed and reflected is precisely a matter of the chemical structure of the dye compound or complex. So it would seem reasonable that dyes, as a general rule, are not chemically modified.

Nevertheless, discussions with one dye supplier revealed that direct dyes can form salt complexes with Ca^{2+} and Mg^{2+} ions in the process water and that fixatives may help form adsorption sites for the dye to bind efficiently to the fibre surfaces before they effectively intercalated into the paper sheet by mechanical actions in the paper machine. They argued that perhaps this could be considered as an example of chemical modification. However, for the purposes of simplification, it was considered best to just assume that no dyes are chemically modified rather than to expect applicants and competent bodies to understand the different dye chemistries that are possible.

For the purposes of interpreting this exemption clause for chemical modification for criterion 4b, the following points are recommended:

- That any inorganic substance that is water soluble and whose ions will react to form different salts, complexes and/or precipitates shall be considered as being chemically modified.
- Any inorganic or organic substance that breaks and/or forms covalent bonds should normally be considered as having been chemically modified.
- The formation or breaking of hydrogen bonds shall not be considered as chemical modification.
- Adsorption and ion-exchange at charged sites on organic molecules and polymers shall not be considered as chemical modification.
- For the purposes of consistent interpretation, dyes, pigments, cationic polymers and wet strength agents shall not be considered as eligible for exemption due to chemical modification.

These recommendations are to be applied for the interpretation of compliance with the EU Ecolabel criteria for Graphic Paper, Tissue Paper and Tissue Products only and should not be taken as infallible claims about chemistry.

8.1.3.2. Specific considerations relating to TiO_2

Despite the fact that there is a joint entry in the ECHA C&L inventory claiming that TiO_2 is not classified, France has submitted a proposal to reclassify Titanium Dioxide as a Cat. 1B carcinogen via the inhalation pathway (H350i) for particles in the 1-4µm size range (CW, 2015: ANSES, 2016).

No official classification of TiO_2 was made prior to the criteria being positively voted in June 2018. Consequently it was not possible to insert any criteria explicitly permitting or excluding the use of TiO_2 in EU Ecolabel paper products. In any case, the use of TiO_2 is almost exclusively for high quality printing papers with good brightness.

Discussions about possible derogation conditions led to the agreement that the use of TiO_2 should only be permitted in Graphic paper that is produced for high quality printing. However, precisely how high quality printing could be defined was not clarified – this may require input from stakeholders in the printing sector, perhaps during the upcoming revision of the EU Ecolabel criteria for Printed Paper.

It was agreed in principle that any derogation conditions for TiO_2 should be linked to worker health and safety. The use of TiO_2 slurries or dry powders in closed dosing systems effectively removes the inhalation hazard for mill workers. Consequently, a provisional proposal for a TiO_2 derogation could perhaps be as follows:

Table 23. Potential derogation entry for TiO2 if it should be classified in the future

Substance	Applicability	Derogated classification(s)	Derogation conditions
Titanium Dioxide	Use in the production of paper for high quality printing purposes	H350i (provisional)	*Avoid dust formation by organizational and /or technical means in order to fully comply with the applicable OEL and strictly respect and comply with the requirements as specified in the SDS.*

Given the timing of the reclassification issue, it is likely that the insertion of any derogation condition for TiO_2 will need to be introduced via an amendment procedure.

8.1.3.3. Rationale for derogations to criterion 4b

Dyes

The two most important dye types used in the paper industry are anionic direct dyes (52% market share) and basic dyes (28% market share) (Rocik, 2003). A cross-check of the ECHA C&L inventory for anionic, cationic and direct dyes revealed the following restricted CLP classifications:

- Group 1 hazards (H350);
- Group 2 hazards (H317, H351, H361d, H400, H410);
- Group 3 hazards (H301, H373, H411, H412, H413).

The less severe Group 3 hazards for aquatic toxicity (H411, H412 and H413) were derogated, upon the condition that the substances are added in such a manner that should ensure its efficient fixation to the paper substrate. However with basic dyes, it was considered necessary to derogate additional hazards in cases where these dyes need to be used. Direct dyes do not adhere well to fibres in papers based on mechanical pulp or other high yield pulp with significant lignin content (not generally used in Tissue Paper and Tissue Products, so only relevant to Graphic Paper). In such cases, the negative surface charge would be attractive to the positive charge of basic dyes instead. However, the hazard profiles of basic dyes found in the ECHA C&L inventory revealed that further derogation for H400, H410 and H317 would be necessary.

Cationic polymers

Cationic polymers are ubiquitous in the paper making process and can be employed for various functions depending on the point in the process they are added, the dosing rate and polymer specific properties such as molecular weight and charge density. Arguably the greatest benefit of using these polymers is the major improvement in dewatering efficiency and thus energy efficiency of the paper machine. However, due to the cationic charged sites on the polymers, they are classified with aquatic toxicity (H411, H412 or H413). Although the polymers are tightly bound to the paper substrate, consistent interpretation of chemical modification it is not possible because it is unknown exactly what happens to cationic charges. As with dyes, for the sake of consistent interpretation, it is assumed that these polymers are not chemically modified and so derogation is necessary.

Wet Strength Agents (WSAs)

Tissue Products are typified by low grammage paper and an ability to absorb water or other liquids. These two properties are complimentary in principle, because a low density structure means the cellulose fibres are loosely packed and have more sites available to share hydrogen bonds with water molecules. However, considering the actual use of the Tissue Product, it is necessary that the tissue fabric retains its structure when wetted. Such functionality invariably requires the use of WSAs to one extent or another.

The most widely used WSAs are based on polyamidoamine-epichlorohydrin (PAE) chemistry. The same polymer family can be used either as a pure WSA (dosed earlier in the papermaking process) or as a Yankee cylinder creping aid (dosed at the end of the tissue paper machine). As with cationic polymers, these polymers have an aquatic toxicity due to surface charges but they are very tightly incorporated into the paper structure.

For consistency of interpretation, these WSAs are not considered to be chemically modified. Consequently it is necessary to derogate for H411, H412 and H413 classifications. A distinction is made in the derogation conditions in terms of residual hazardous monomer contents that are permitted. A lower residual threshold (0.05% instead of 0.35%) is set when the polymer is dosed as a creeping aid – the main reason for this is because there is a higher risk of residual monomers being incorporated into the paper when it is dosed near the end of the paper-making process. This follows the same rationale as the Nordic Ecolabel. It should also be noted that the 0.35% limit set is significantly more ambitious than the previous limit set in the 2009 Decision (0.70%).

The final derogation relates to glyoxal wet strength agents and was inserted once it was realised that residual contents of glyoxal present in recycled paper could result in concentrations that exceed the 0.10% w/w threshold that is set for criterion 4b (i.e. the 1.5 mg/dm^2 permitted in criterion 6c could equate to a content of 0.3 to 1.5% w/w depending on the tissue paper grammage ranging from 10 to 50 g/m^2. The most important consideration with glyoxal is that it is not intentionally added during the papermaking process but is simply due to residual content from any RCF pulp or converting broke.

8.2 Specific hazardous substance restrictions

8.2.1 Criteria proposal – 4c, 4d, 4e, 4f, 4g, 4h, 4i and 4j

Proposed Criterion 4c): Chlorine

(For Graphic Paper, Tissue Paper and Tissue Products)

Note: This requirement shall apply to pulp and paper producers. While it also applies to the bleaching of recycled fibres, it is accepted that the fibres in their previous life cycle may have been bleached with chlorine gas.

Chlorine gas shall not be used as a bleaching agent. This requirement does not apply to chlorine gas related to the production and use of chlorine dioxide.

Assessment and verification: *The applicant shall provide a declaration that chlorine gas has not been used as a bleaching agent in the paper production process, together with declarations from any relevant pulp suppliers.*

Proposed Criterion 4d) APEOs

(For Graphic Paper, Tissue Paper and Tissue Products)

Note: This requirement shall apply to pulp and paper producers.

APEOs or other alkylphenol derivatives shall not be added to cleaning chemicals, de-inking chemicals, foam inhibitors, dispersants or coatings. Alkylphenol derivatives are defined as substances that upon degradation produce alkylphenols.

Assessment and verification: *The applicant shall provide a declaration(s) from its chemical supplier(s) that APEOs or other alkylphenol derivatives have not been added to these products.*

Criterion 4e) Surfactants used in deinking

(For Graphic Paper, Tissue Paper and Tissue Products)

Note: This requirement shall apply to the producer(s) of de-inked pulp.

All surfactants used in de-inking processes shall demonstrate ready biodegradability or inherent ultimate biodegradability (see test methods and pass levels below). The only exemption to this requirement shall be the use of surfactants based on silicone derivatives provided that paper sludge from the de-inking process is incinerated.

Assessment and verification: *The applicant shall provide a declaration of compliance with this criterion together with the relevant safety data sheets or test reports for each surfactant. These shall indicate the test method, threshold and conclusion reached using one of the following test methods and pass levels:*

- For ready biodegradability: OECD No 301 A-F (or equivalent ISO standards) with a percentage degradation (including absorption) within 28 days of at least 70 % for 301 A and E, and of at least 60 % for 301 B, C, D and F.

- For inherent ultimate biodegradability: OECD 302 A-C (or equivalent ISO standards), with a percentage degradation (including adsorption) within 28 days of at least 70 % for 302 A and B, and of at least 60 % for 302 C.

In cases where silicone-based surfactants are used, the applicant shall provide a safety data sheet for the chemicals used and a declaration that paper sludge from the de-inking process is incinerated, including details of the destination incineration facility or facilities.

Criterion 4f) Biocidal product restrictions for slime control

(For Graphic Paper , Tissue and Tissue Products)

Note: This requirement shall apply to the paper producer.

The active substances in biocidal products used to counter slime-forming organisms in circulation water systems containing fibres shall have been approved for this purpose, or be under examination pending a decision on approval, under Regulation (EU) No 528/2012 and shall not be potentially bio-accumulative.

For the purposes of this criterion, the potential to bio-accumulate shall be characterised by log Kow (log octanol/water partition coefficient) ≤3.0 or an experimentally determined bioconcentration factor ≤100.

Assessment and verification: *The applicant shall provide a declaration of compliance with this criterion together with the relevant material safety data sheet or test report. This shall indicate the test method, threshold and conclusion reached using one of the following test methods: OECD 107, 117 or 305 A-E.*

Criterion 4g)Azo dye restrictions

(For Graphic Paper, Tissue Paper and Tissue Products)

Note: This requirement shall apply to the paper producer.

Azo dyes, which by reductive cleavage of one or more azo groups may release one or more of the aromatic amines listed in Directive 2002/61/EC or Regulation (EC) No 1907/2006 Annex XVII, Appendix 8, shall not be used in the production of EU Ecolabel graphic paper.

Assessment and verification: *The applicant shall provide a declaration of compliance with this criterion from the supplier(s) of all colourants used in the production process for EU Ecolabel graphic paper. The colourant supplier declaration should be supported by test reports according to the appropriate methods described in Appendix 10 to Annex XVII to Regulation (EC) No 1907/2006 or equivalent methods..*

Criterion 4h) Metal complex dye stuffs or pigments

(For Graphic Paper)

Note: This requirement shall apply to the paper producer. See definition of metal-based pigments and dyes in the preamble of this Annex.

Dyes or pigments based on aluminium*, silver, arsenic, barium, cadmium, cobalt, chromium, copper*, mercury, manganese, nickel, lead, selenium, antimony, tin or zinc shall not be used.

*The restriction for copper shall be exempted in the case of copper phthalocyanine and the restriction for aluminium shall not apply to aluminosilicates.

Assessment and verification: *The applicant shall provide a declaration of compliance with the requirements of this criterion from the supplier(s) of all colourants used in the production process for EU Ecolabel graphic paper. The supplier declaration(s) shall be supported by safety data sheets or other relevant documentation.*

(For Tissue Paper and Tissue Products)

Note: This requirement shall apply to the paper producer or, where relevant, to the tissue paper converter. See definition of metal-based pigments and dyes in the preamble of this Annex.

Dyes or pigments based on aluminium*, silver, arsenic, barium, cadmium, cobalt, chromium, mercury, manganese, nickel, lead, selenium, antimony, tin or zinc shall not be used.

*The restriction for aluminium shall not apply to aluminosilicates.

Assessment and verification: *The applicant shall provide a declaration of compliance with the requirements of this criterion from the supplier(s) of all colourants used in the production process for EU Ecolabel tissue products. The supplier declaration(s) shall be supported by safety data sheets or other relevant documentation.*

Criterion 4i) Ionic impurities in dye stuffs

(For Graphic Paper)

Note: This requirement shall apply to the paper producer.

The levels of ionic impurities in the dye-stuffs used shall not exceed the following limits: silver 100 ppm; arsenic 50 ppm; barium 100 ppm; cadmium 20 ppm; cobalt 500 ppm; chromium 100 ppm; copper 250 ppm; mercury 4 ppm; nickel 200 ppm; lead 100 ppm; selenium 20 ppm; antimony 50 ppm; tin 250 ppm; zinc 1 500 ppm.

The restriction for copper impurities shall not apply to dye-stuffs based on copper phthalocyanine.

Assessment and verification: *The applicant shall provide a declaration of compliance with the requirements of this criterion from the supplier(s) of all colourants used in the production process for EU Ecolabel graphic paper. The supplier declaration(s) shall be supported by safety data sheets or other relevant documentation.*

(For Tissue Paper and Tissue Products)

Note: This requirement shall apply to the paper producer or, where relevant, to the tissue paper converter.

The levels of ionic impurities in the dyestuffs used shall not exceed the following limits: silver 100 ppm; arsenic 50 ppm; barium 100 ppm; cadmium 20 ppm; cobalt 500 ppm; chromium 100 ppm; mercury 4 ppm; nickel 200 ppm; lead 100 ppm; selenium 20 ppm; antimony 50 ppm; tin 250 ppm; zinc 1 500 ppm.

Assessment and verification: *The applicant shall provide a declaration of compliance with the requirements of this criterion from the supplier(s) of all colourants used in the production process for EU Ecolabel tissue paper. The supplier declaration(s) shall be supported by safety data sheets or other relevant documentation.*

Criterion 4j) Lotions

(For Tissue Paper and Tissue Products)

No substances that are classified as H317, H334, CMR or listed on the Candidate List for Substances of Very High Concern shall be added to lotion formulations used during the conversion of EU Ecolabel tissue products. Furthermore,

no parabens, triclosan, formaldehyde, formaldehyde releasers or methylisothiazolinone shall be added to lotion formulations.

Furthermore, no lotion formulation used shall be dosed in quantities that result in any individual substances with the CLP restricted classifications listed in criterion 4(b) being present in quantities exceeding 0.010 % (w/w) of the final tissue product. The sum of substances with any particular restricted CLP classifications shall not exceed 0.070 % (w/w) of the tissue product.

Assessment and verification: *The applicant shall provide a list of any relevant lotion formulations used in the production of EU Ecolabel tissue products together with declarations of compliance from the respective suppliers of those lotion formulations, relevant safety data sheets and, for demonstrating compliance with the limits in the final product, calculations based on dosing rates used by the applicant that estimate the concentrations of any restricted CLP substances in the formulation that would remain in the final EU Ecolabel tissue product.*

8.2.2 Supporting rationale

Chlorine

The criterion for chlorine has remained unchanged. The use of free chlorine continues to be excluded in the production of EU Ecolabel Graphic Paper, Tissue Paper and Tissue Products. The new wording clarifies that this exclusion applies not only to the chemical pulp but also to RCF pulp and mechanical pulp and any bleaching operations that may be carried out in paper mills.

Although excluded from use as a bleaching agent per se, chlorine gas (Cl_2) is allowed for the onsite production of chlorine dioxide (ClO_2) which is a much more stable bleaching agent compared to Cl_2, resulting in lower AOX emissions (see section 5.2).

Chlorine gas is a globally traded commodity chemical linked to the production of caustic soda (NaOH) and which can be produced by one of three established processes: the diaphragm process; the membrane process and the mercury process. The JRC were requested to conduct further research to determine whether or not it would be worthwhile to introduce a new criterion that would prevent the use of chlorine that had been produced by the Mercury process. It is estimated that only around 5% of global chlorine production capacity is based on the Mercury process today and that the pulp and paper sector is responsible for around 5% of total demand for chlorine (CEPS, 2014). Consequently, it was decided that the potential benefit of introducing this additional requirement would not be justified.

APEOs

The criterion for APEOs has remained unchanged during the entire revision process except for the minor clarification that screening for APEOs should not apply to coating chemicals for tissue paper, due to their non-use for that product group.

Surfactants

The surfactant criterion continues to only be applicable to surfactants used during deinking processes, which represents the largest use of these chemicals in the sector. Aligning with the Nordic Ecolabel approach, the use of less biodegradable but more efficient silicone surfactants is permitted (15 to 20 times more efficient than fatty acids normally used), so long as the deinking sludge is incinerated.

Biocidal product restrictions for slime control

The criteria have simply been updated to cover the new Biocidal Products Regulation that came into force in 2012. The scope of the criterion is better reflected in the title as well. From a Tissue Paper perspective, there is now a clear definition of what should be considered as non-bioaccumulative. Concerns about allowing the use of active substance and products that are "*under evaluation*" but are later on not approved were expressed during discussions. However, it was clarified that such a product or substance would be removed from the market should it not pass the approval process.

Azo-dye restrictions

The wording of this criterion has been adapted following consultation with industry stakeholders to clarify that these chemicals should not be used in the first place, thus placing the onus on the chemical supplier to demonstrate such compliance for the dyes they supply. Consequently, there is no need to reproduce the list of restricted azo-dyes in an appendix.

Metal-complex dye restrictions

A definition has now been provided so that applicants, license holders, suppliers and CBs can clearly understood which chemicals this criterion applies to. It is now specifically stated that Aluminium metal complexes are not to be confused with aluminosilicates. This criterion is new for Tissue Paper and Tissue Products and it was requested that the restriction on copper be removed because there are a number of commercially accepted shades accepted by global tissue brands that need to use one or more different copper complexes.

Ionic impurities in dye stuffs

A definition has now been provided so that applicants, license holders, suppliers and CBs can clearly understood what is meant by the term "*dye*". As with the metal complex dye restrictions, this requirement is new for tissue and it was requested that the limit for copper be removed. Previous limits for Fe and Mn were also removed (for both Graphic and Tissue Paper and Tissue Products) since they are not considered as toxic heavy metals.

Lotions

It was discussed at length whether or not lotions should be excluded from the scope. There was a clear perception issue associating the use of lotions with moist/wet wipes and/or fragranced tissue. Stakeholders with this perception reasoned that since wet wipes and fragranced tissue products are already excluded from the scope, lotions should also be specifically banned from EU Ecolabel products too.

However, it was explained that lotions can also be used during conversion in lower doses to soften the paper. Such Tissue Products are often labelled as "soft" or "extra soft" and can be dry to the touch. It was argued that these products should remain in the scope. One leading licence holder added that they had approximately 20-40 lotion-treated tissue products that are currently labelled under Decision 2009/568/EC.

Consequently, lotions are permitted subject to compliance with classification restrictions that are 10 times more stringent than the horizontal criterion 4b and with complete bans on the use of any CMRs, H317 or H334 classified sensitisers and selected specific substances.

8.2.3. Previous criteria that have been moved or removed

The specific criteria for acrylamide residual monomer restrictions in polyacrylamide (≤700ppm) and any residual monomers with any of a broad range restricted CLP classifications (≤100ppm) has been deleted following considerable stakeholder discussion on this matter. The main argument for removing the restriction was based on the fact that this information is not legally obliged to be shared in Safety Data Sheets and represents a disproportionately large administrative burden when compared to the potential environmental benefits that could be achieved.

With regards to the residual acrylamide monomer, this substance is highly biodegradable and is not detected either in the final product or in wastewater effluent. The main concern with the residual monomer is exposure to workers when handling bulk deliveries of polyacrylamide. Consequently, it was decided to bring restrictions for acrylamide residual monomers under the horizontal criterion 4b and to link the derogation condition to safe handling and dosing of the chemical in paper mills.

Softeners and additives of natural origin have been directly moved under the horizontal hazardous substance criteria with no specific derogations since none were requested nor discussed during the revision process.

Following much debate, it was decided to exclude fragrances from the scope for the EU Ecolabel Tissue Paper and Tissue Products product group. Even though fragranced tissue is a growing market share, especially in countries such as Germany and Austria, the overall opinion of the EU Ecolabelling Board was in favour of exclusion due to the fact that fragrance is a non-essential property of tissue products, but may be linked to some negative traits such as the increased risk of allergies and sensitisation (skin or respiratory).

9. Criterion 5: Waste Management

Graphic Paper
All pulp and paper production sites shall have a system in place for the handling of waste arising from the production process and a waste management and minimisation plan that describes the production process and includes information on the following aspects: 1) procedures in place for waste prevention; 2) procedures in place for waste separation, reuse and recycling; 3) procedures in place for the safe handling of hazardous waste; 4) continuous improvement objectives and targets relating to the reduction of waste generation and the increase of reuse and recycling rates.
Tissue Paper and Tissue Products
All pulp and paper production sites, including converted tissue production sites, shall have a system in place for the handling of waste arising from the production process and a waste management and minimisation plan that describes the production process and includes information on the following aspects: 1) procedures in place for waste prevention; 2) procedures in place for waste separation, reuse, and recycling; 3) procedures in place for the safe handling of hazardous waste; 4) continuous improvement objectives and targets relating to the reduction of waste generation and the increase of reuse and recycling rates.
Assessment and verification: *The applicant shall provide a waste minimisation and management plan for each of the sites concerned and a declaration of compliance with the criterion.* *Applicants registered with EU Eco-Management and Audit Scheme (EMAS) and/or certified according to ISO 14001 shall be considered as having fulfilled this criterion if:* *1) the inclusion of waste management is documented in the EMAS environmental statement for the production site(s), or* *2) the inclusion of waste management is sufficiently addressed by the ISO 14001 certification for the production site(s).*

The industrial waste is difficult to categorize because different data sources use different categories and waste from different processes may be mixed during waste (water) treatment at the paper mill. Following Van Ewjika et al., (2018) waste might be aggregated in the following categories based on their properties and volume (Figure 17):

1. End-of-life discards: all the solid paper waste discarded from residential and commercial sectors, excluding the paper industry;
2. Paper in sewage-considered separately from end-of-life discards because the fibres are not available for recycling.
3. Black liquor produced during the chemical (Kraft) pulping process. It has a high heating value and is used for on-site energy recovery;
4. Recycling sludge generated during pulping and deinking of paper for recycling;
5. Papermaking waste consists of losses from the conversion of pulp and non-fibrous material into paper and the conversion of paper into paper products. It is a clean and convenient source of paper for recycling.
6. Sludge and rejects cover the aggregate losses from chemical pulping (excluding black liquor and by-products) and mechanical pulping.
7. Causticizing waste consists of inorganic sludge generated in the chemical recovery cycle. It includes green liquor dregs, lime mud, and slaker grits.
8. Boiler ash results from organic waste combustion. The focus of this article is on wood and sludge ash and it excludes mixed ash from cofiring of, for example, coal and wood. Boiler ash has a high alkalinity and is cementitious (Bird and Talberth, 2008).

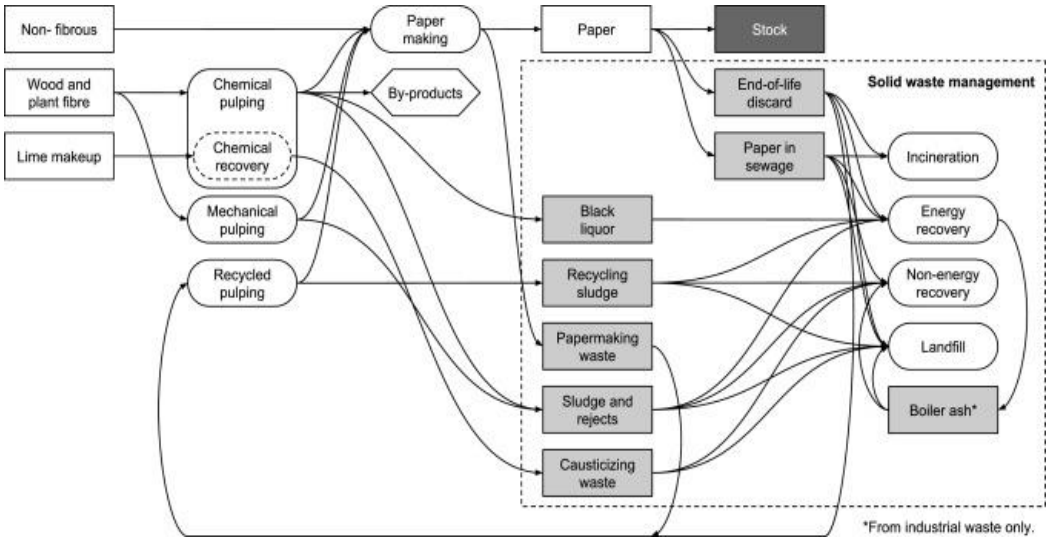


Figure 17. Flows (rectangular boxes) and processes (rounded boxes) in the paper life cycle (Van Ewjika et al, 2018)

The BAT 12 (JRC, 2015) indicates how the solid waste generation could be minimised by means of additional processes and/or availability to other industries (Table 24).

Table 24: Waste Management BAT (JRC, 2015).

Technique	Description
Pre-treatment of process residues before reuse or recycling	*Pre-treatment comprises techniques such as:* • dewatering e.g. of sludge, bark or rejects and in some cases drying to enhance reusability before utilisation (e.g. increase calorific value before incineration); or • dewatering to reduce weight and volume for transport. For dewatering belt presses, screw presses, decanter centrifuges or chamber filter presses are used; • crushing/shredding of rejects e.g. from RCF processes and removal of metallic parts, to enhance combustion characteristics before incineration; • biological stabilisation before dewatering, in case agricultural utilisation is foreseen
Material recovery and recycling of process residues on site	*Processes for material recovery comprise techniques such as:* • separation of fibres from water streams and recirculation into feed stock; • recovery of chemical additives, coating pigments, etc.; • recovery of cooking chemicals by means of recovery boilers, causticising, etc.
Energy recovery on- or off-site from wastes with high organic content	Residues from debarking, chipping, screening etc. like bark, fibre sludge or other mainly organic residues are burnt due to their calorific value in incinerators or biomass power plants for energy recovery
External material utilisation	*Material utilisation of suitable waste from pulp and paper production can be done in other industrial sectors, e.g. by:* • firing in the kilns or mixing with feedstock in cement, ceramics or bricks production (includes also energy recovery); • composting paper sludge or land spreading suitable waste fractions in agriculture; • use of inorganic waste fractions (sand, stones, grits, ashes, lime) for construction, such as paving, roads, covering layers etc. The suitability of waste fractions for off-site utilisation is determined by the composition of the waste (e.g. inorganic/mineral content) and the evidence that the foreseen recycling operation does not cause harm to the environment or health
Pre-treatment of waste fraction before disposal	Pre-treatment of waste before disposal comprises measures(dewatering, drying etc.) reducing the weight and volume for transport or disposal

There is limited data availability to assess the total amount of waste generated at pulp and paper mills. Most pulp and paper mills already implemented internal rejects handling procedures. Often the flow of internally treated material is not registered quantitatively, and this is one of the reasons of limited data availability to assess the total amount of waste generated at pulp and paper mills (including process rejects, and on – site treatment).

A waste management system is a valuable tool that ensures control over the material flow, and drives to waste prevention, and preparing for reuse, recovery, recycling, and safe disposal. Therefore the key objective of the criterion is to ensure the implementation of a long-term waste management strategy.

During the development of the EU Ecolabel criteria, questions arose about the potential overlap between the EU Ecolabel criteria and the Eco-management Audit Scheme (EMAS).

EMAS allows organisations to evaluate, report, and improve their environmental performance. The companies that wish to participate in EMAS should develop an environmental management system (EMAS) and commit to continuously improving their environmental performance. They also must regularly publish an environmental statement highlighting their progress. EMAS registration ensures that the EMAS implemented by an organisation is verified by a third party, and focusses on the actions under the direct control of the company as well as actions on which it has a considerable influence. EMAS does not set targets or benchmarks for environmental goals; however, Sectoral Reference Documents are available or under development for certain economic sectors, e.g. tourism, which can be used as general guidelines. These documents contain the description of best practices for improving environmental performance, as well as indicators and benchmarks to monitor the progress achieved. They aim to provide guidance and inspiration to companies on how to improve their environmental performance. EMAS-registered organisations from the sectors where Sectoral Reference Documents are available must take these documents into account, but there is no obligation to follow the best practices or achieve any benchmark.

EMAS registration proves that a company is committed to manage and improve its environmental performance by using a structured framework for considering its most relevant environmental impacts, monitoring, reporting publicly and continuously improving its environmental performance, and, potentially, achieving the best performance thanks to the voluntary implementation of best practices.

EU Ecolabel and EMAS when used together are complementary: using the EU Ecolabel as a tool to communicate to the market that a certain service or product achieves a very high environmental performance and EMAS as a process to further improve environmental performance at an organisational level. ISO 14001 certification could also be used as equivalent to achieve objectives set by EMAS.

The present proposal for the Criterion 5 (Waste management) is an example of how the two voluntary frameworks can counterpart each other. Additional specification has been added under criterion assessment and verification in order to ensure that the subject matter of Criterion 5 is address by the EMAS.

10. Criterion 6: Fitness for use (graphic paper)

Graphic Paper
The paper product shall be suitable for its purpose.
Assessment and verification: *The applicant shall provide a declaration of compliance with this criterion supported by appropriate documentation.* *Producers shall guarantee the fitness for use of their products, providing documentation that demonstrates the product quality in accordance with EN ISO/IEC 17050. The standard provides general criteria for suppliers' declaration of conformity with normative documents.*

10.1. Supporting rationale

Paper products are essentially single use in nature. Paper quality requirements are directly related to the final product fitness for use requirements such as: smoothness, brightness, opacity, strength, grammage etc.

It is therefore very complex to fix any common set of technical requirements in EU Ecolabel criteria because the market reality is that product quality is a broad spectrum, with different grades being suitable for multiple purposes and other grades being particularly useful for other, more specialised purposes. There are differences in how a given paper will perform in different types of printing process (e.g. household inkjet, larger scale office printers or in commercial scale print houses for mass printing).

Considering the existing markets for Graphic Paper and the standard practice that is already prevalent in them, it is considered of little added value to specify fitness for use requirements in EU Ecolabel criteria.

ISO/IEC 17050-1 and ISO/IEC 17050-2 specify general requirements for supplier declarations of conformity in cases where it is desirable, or necessary, that conformity of an object to the specified requirements be attested, irrespective of the sector involved.

The assessment of "*fitness for use*" and common quality of the product differs with different market segments. Fitness for use is definitely not linked with specific technical criteria (strength, absorption etc.) but with market conditions, regulated by specific quality specifications (internal) and/or by general technical specifications which are the core of the contract between producers and distributors. The verification for this criterion is made by controlling the compliance to internal quality controls, to external (tender/technical/…) specifications, and checking the grounds for claim.

A paper that is not fit to be used will not be chosen by consumers, especially high volume customers. Moreover almost all paper producers already have internal procedures to manage the complaints on their products under their ISO 9001 Quality Management System.

11. Criterion 6: Final product requirements

Tissue Paper and Tissue Product
Criterion 6(a) Dyes and optical brighteners For dyed tissue paper, good fastness (level 4 or higher) shall be demonstrated according to the short procedure defined in EN 646. For tissue paper treated with optical brightening agents, good fastness (level 4 or higher) shall be demonstrated according to the short procedure defined in EN 648. ***Assessment and verification:*** *The applicant or the chemical supplier(s) shall provide a declaration of compliance with this criterion supported by relevant test reports in accordance with standards EN 646 and/or EN 648 as appropriate.* *Otherwise, the applicant shall provide a declaration stating that no dyes or optical brightening agents have been used.* **Criterion 6(b) Slimicides and antimicrobial substances** Samples of the final tissue product shall not result in the growth inhibition of micro-organisms in accordance with EN 1104. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion supported by relevant test reports in accordance with EN 1104.* **Criterion 6(c) Product safety** Any final tissue product that contains recycled fibre shall not contain any of the following hazardous substances above the specified limits and according to the specified test standards: - Formaldehyde: 1 mg/dm2 in accordance with EN 1541 (cold water extraction); - Glyoxal: 1.5 mg/dm2 in accordance with DIN 54603; - Pentachlorophenol (PCP): 2 mg/kg in accordance with EN ISO 15320 (cold water extraction). ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion supported by relevant test reports in accordance with the respective standards.* **Criterion 6(d) Fitness for use** The EU Ecolabel tissue product needs to meet all respective requirements of the country where it is placed on the market. For structured tissue paper, the absorbency of the individual base sheet of tissue paper before conversion shall be equal to or higher than 10.0 g water/g tissue paper. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with the criterion supported by relevant documentation.* *Producers shall guarantee the fitness for use of their products, providing documentation that demonstrates the product quality in accordance with EN ISO/IEC 17050. The standard provides general criteria for suppliers' declaration of conformity with normative documents.* *For structured tissue paper, the applicant shall provide a declaration of compliance with the requirement supported by a relevant test report in accordance with EN ISO 12625-8:2010.*

11.1. Supporting rationale

There is a wide range of products that are based on tissue paper, including toilet paper, wipes, kitchen towels, handkerchiefs, facial tissues, household towels, napkins, products for industrial use, etc. These commodities must be suitable for their intended purpose ensured by its functionality and safety. Accordingly, the title of criterion was renamed from Fitness for use to Final product requirements to more accurately reflect the intention of the criterion.

One of the key aspects that should be addressed under tissue product requirements is product safety. This is understood to form part of the manufacturers' good practice. In fact, following the prescription of BfR (Bundesinstitut fuer Risikobewertung), based on responsible manufacturing practices and their duty of care, manufacturers and those responsible for bringing these commodities onto the market take full responsibility for ensuring that they are not harmful to health (Bundesgesundheitsbl, 1996). Multi-purpose use products that are not specifically intended for contact with foodstuffs (but might be used for this purpose), and characterised by the absence of significant migration, and the low exposure of the consumers are covered by the specific policy statement for 'Tissue paper kitchen towels and napkins (PHC, 2004).

The guideline recommends specifications that tissue paper kitchen towels and napkins should comply with to achieve safety of use for the consumer in line with the general principles of Product Safety Directive 2001/95/EC. This assumes that tissue is only occasionally used in contact with food, and when it occurs it is only for a short time.

The "Tissue Guideline" is not mandatory and therefore not legally binding, but it can be used as a reference document by those countries that do not have a national legislation for paper. Skin safety shall be considered for tissue that comes into direct contact with the body i.e. handkerchief or toilet paper. There is no European legislation or recommendation for sanitary papers (Walldal).

Directly or indirectly, tissue and hygiene products are subject to national and international standards, institutional guidelines or industry standards. It is understood that a part of best practice is to be equipped with management systems that comply with existing international standards regarding product quality, safety and legality (i.e. Consumer Products standard). In this sense, in Germany, the BfR has published "Guidelines for Evaluating Sanitary Papers. The guidelines include a list of raw materials and a number of criteria for the finished product (limit values and test methods).

The requirements stated in former criterion 5 (Product safety) are proposed to be integrated under criterion 6 – more specifically as criteria 6a), 6b) and 6c). The continued relevance of these requirements is due to the fact that some multifunctional tissue paper products e.g. kitchen towels and napkins may be put in contact with food by end users. Even considering limited migration capacity of certain functional chemical additives from tissue into food, it is considered crucial to ensure that the EU Ecolabel product is fulfilling the safety requirements.

Furthermore, ISO 12625 is considered when analysing fitness for use for tissue paper and tissue product. It also makes a reference to ISO 15755 as standard recommended for the detection of impurities and contraries in tissue paper and tissue products.

11.1.1 Product safety

Fastness of dyes and optical brighteners (EN 646 and EN 648)

One of the final product quality requirements is related to colour fastness for dyed papers as measured according to EN 646.

For tissue paper treated with optical brightening agents, good fastness (level 4 or higher) shall be demonstrated according to the short procedure defined in EN 648.

Both standards can generate results in terms of fastness grading (1 to 5) although the comparative method of assessing fastness is different. In EN 646 a grey-scale based on

ISO 105-A03 is used while in EN 648, comparison is made under a UV lamp with control samples stained with a standard solution of fluorescent whitening agent.

Slimicides and antimicrobial substances (EN 1104)

The aim of this standard is to determine if the paper releases any anti-microbial substances. This test can guarantee against the deliberate or accidental impregnation of the paper substrate with anti-microbial substances.

Product safety (EN 1541, DIN 54603 and EN ISO 15320)

The aim of these requirements is to provide control of the potential occurrence of certain hazardous substances that can be found in tissue paper products. The requirement refers to any tissue paper product that contains recycled fibre.

EN 1541 - Formaldehyde

The most recent version of EN 1541 was published in 2001. The actual detection limit of the method is reported as mg/kg (1mg/kg to be precise). When translated into units of mg/dm2, the detection limit would be 0.001 mg/dm2 if the grammage of the paper was 100 g/m2.

EN 15320 - PCP

The most recent version of the EN ISO 15320 standard was published in 2011. The detection limit is 0.05 mg PCP/kg. The test method was originally intended only for food contact paper and board but is not widely applied to other types of paper and board.

11.1.2. Structured tissue paper minimum water absorbance

The absorbance capacity can be expressed as g/m^2 or g/g. In particular the latter metric is a use example of the "*efficiency of fibre use*" for a given performance. Since it is possible to alter the grammage (g/m^2) of tissue paper products by combining identical or different plies, a fairer way to examine performance is to assess the performance of the individual ply or base-sheet.

Using water absorbance data provided by stakeholders, it was possible to distinguish between the performance of structured tissue and conventional tissue base sheets (i.e. single plies) in Figure 18.

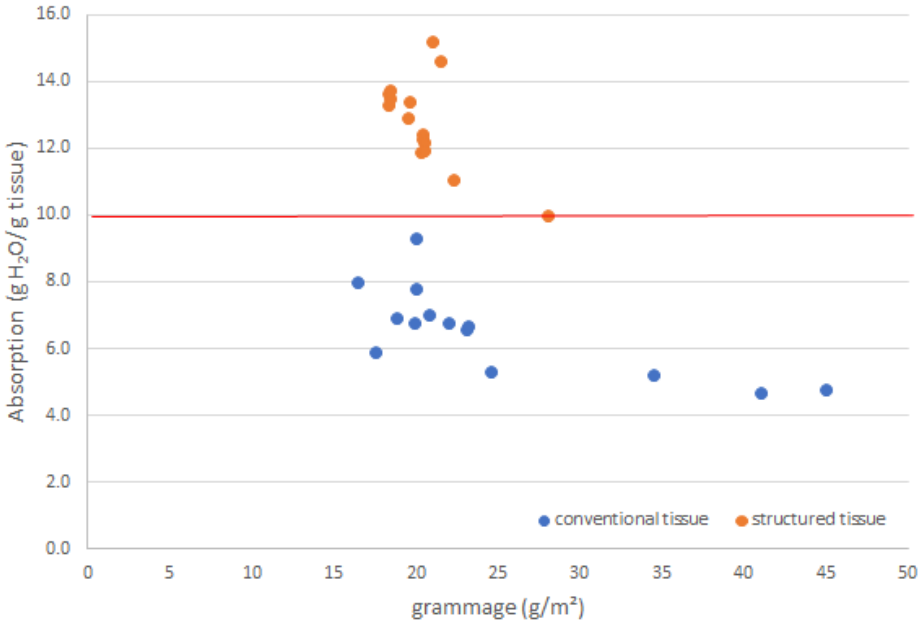


Figure 18. Distinction of absorbance capacity between "*structured*" and conventional tissue base-sheets.

The data above show a clear distinction between conventional and structured tissue base sheets in terms of achievable water absorbance. The majority of conventional products fail to exceed 8.0 g/g absorption whereas most structured tissue base sheets exceeded 12.0 g/g. In no cases did any structured tissue base sheets achieve less than 10.0 g/g or any conventional tissue base sheets exceed 10.0 g/g absorption. Consequently a performance requirement of a minimum of 10g/g water absorbance was decided upon as a useful prerequisite for any labelling of tissue products that are permitted the higher specific energy consumption reference values (and associated CO_2 and NO_x emission reference values) because they produce structured tissue base sheets with a proven superior water absorption.

Water absorption should be verified in accordance with EN ISO 12625-8 (*Tissue paper and tissue products - Part 8: Water-absorption time and water-absorption capacity, basket-immersion test method),* which specifies a basket-immersion test method for the determination of water-absorption time and water-absorption capacity of tissue paper and tissue products. It is expressly stated that the detection of impurities and contraries in tissue paper and tissue products be applied according to ISO 15755.

12. Criterion 7: Information on the packaging (graphic paper)

Graphic Paper
At least one of the following pieces of information shall appear on the product packaging: 'Please print double sided' (applicable for paper for office printing purposes) 'Please collect used paper for recycling' ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion, supported by an image of the product packaging bearing the information required.*

12.1. Supporting rationale

Within the course of the project most of the stakeholders were not in favour of any change in the existing criterion. It was argued that the proposed text is too long and there is no space for the text in the packaging as the packaging features on average 7 languages; sometimes up to 13 languages. For this reason the optional text 'Please print double sided" is proposed for graphic paper designated for office printing purposes.

13. Criterion 7 / Criterion 8: Information appearing on the EU Ecolabel

Graphic Paper (Criterion 8)/ Tissue Paper and Tissue Product (Criterion 7)
The applicant shall follow the instructions on how to properly use the EU Ecolabel logo provided in the EU Ecolabel Logo Guidelines: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf If the optional label with text box is used, it shall contain the following three statements: - Low emissions to air and water during production; - Low energy use during production; - xx% sustainably sourced fibres / xx% recycled fibres (as appropriate). ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion, supported by an image of the product packaging that clearly shows the label, the registration/licence number and, where relevant, the statements that can be displayed together with the label.*

13.1. Supporting rationale

The criterion provides a more accurate reflection of the key issues addressed by the range of criteria proposed.

14. Impact of changes to criteria

14.1. Changes in the scope

The scope for the product group "*Graphic Paper*" is effectively the same as that defined previously for "*Copying and Graphic Paper*" and "*Newsprint Paper*" but is now combined in a single Annex of a single Decision instead of two separate Decisions. The most significant change is the removal of the arbitrary upper limit on grammage of 400 g/m^2. By removing this limit, one unnecessary barrier for certain paper stationary products to carry the EU Ecolabel under the product group "*Converted Paper*" has been removed.

Tissue Paper and Tissue Products have also been merged under the same Decision as Graphic Paper, but as a separate Annex due to the fact that a code number and scope applies. The scope for "*Tissue Paper and Tissue Products*" has been reworded to best reflect the standard definitions set out in EN ISO 12625-1:2011. A distinction has been made between the term "*Tissue Paper*" and "*Tissue Products*", with the former referring to mother reels that may be licensed prior to B2B transactions between paper producers and converters, while the latter refers to converted tissue paper products. This should bring clarity now about the possibility to licensed unconverted Tissue Paper reels. Fragranced tissue paper has now been specifically removed from the scope. Although "*structured tissue*" was never excluded from the previous scope, now a definition has been inserted because a distinction is now made in the new criteria for specific energy consumption reference values (and consequently for CO_2 and NO_x emissions). For these higher thresholds to apply, a minimum water absorbency of the structured tissue base sheet must be met (≥ 10g H_2O /g tissue as per criterion 6d in Annex II).

14.2. Changes in the criteria

Although no new criteria have been added, the precise wording, sub-structure and ambition level has been updated for most criteria to reflect data gathered from diverse sources in the literature and from stakeholder contributions. The impacts of the changes to the four main criteria are explained below. For all of these criteria, it is worth mentioning that the impacts are described on a per criterion basis, the cumulative effect of all of these changes is not possible to evaluate due to the complexity of applying a number of pass-fail conditions to an entire industry, which consists of over 900 mills in CEPI countries alone.

14.2.1. Criterion 1: emissions to water and air

This is the most complex criterion to assess because it constitutes six different emissions: COD, P and AOX to water and S, NO_x and CO_2 to air. Furthermore, four of the emissions are combined to form a single overall score related to defined reference values (COD, P, S and NO_x) while a fixed limit for AOX is set only for ECF pulp mills and CO_2 emission limits are fixed in different ways for Graphic Paper and for Tissue Paper.

Considering the new reference values for emissions of COD, P, NO_x and S in combination with the reduced flexibility of maximum scores for each individual emission (previous up to 1.5x reference value was allowed, now it is 1.3x reference value) the number of mills able to comply dropped from 75% of mills with available data to 57.5% (i.e. from 30/40 mills to 23/40 mills). If the 1.3x reference value allowance for individual emissions had been removed (i.e. 1.0x reference value), only 17.5% of mills would have been able to meet criterion 1a) (i.e. 7/40 mills), highlighting the importance of having that flexibility.

With AOX emissions, the level of 0.17 mg/kg can only be met by 26 of the 37 relevant mills (70%) for which AOX emission data was available.

The impact of the CO_2 criterion needs to be considered separately for Graphic Paper and for Tissue Paper. Because fixed CO_2 emission limits are set at the level of the pulp mix plus paper machine emissions, it was not possible to compare to actual mills because the

pulp mix can vary and this information was not made available to the JRC. However, simply focussing on the threshold limits, it can be stated that the ambition level for conventional tissue paper has been increased by 20% (limit reduced from 1500 to 1200 kg CO_2/ADt). The new higher limit for structured tissue could result in higher quality and more fibre efficient products produced by hybrid TAD technologies but not by the less efficient traditional TAD technologies.

For Graphic Paper, the incorporation of mechanical pulp is incentivised (60% higher emission allowed than chemical pulp) to a large extent and the use of deinked pulp to a lesser extent (10% higher emission allowed than chemical pulp). The extra allowance for non-integrated production (+100 kg CO_2/ADt) in the previous criteria has been removed. Consequently the ambition level is approximately 10% higher for paper that is mainly based on non-integrated chemical pulp.

14.2.2. Criterion 2: Energy use

Overall, the ambition level of the energy use criteria has increased significantly. The ambition level is based on comparison to a series of energy reference values (fuel and electricity) and these are summed for the total weighted pulp and paper energy consumption to produce a score for fuel and a score for electricity.

The previous criteria set a maximum score of 1.5x reference value for fuel and 1.5x reference value for electricity. The new criteria introduce flexibility by simply saying that Fuel + Electricity scores should be less than 2.5. Even without any change to the reference values, this could be considered as an increase in the ambition level of 17% (i.e. a 0.5 drop from a score of 3.0 or of 0.25 from individual scores of 1.5). Fuel and electricity scores were combined to allow for flexibility in mill process evolution, where a tendency to greater automation and digitalisation increases electricity consumption but can reduce fuel consumption due to better optimisation.

The increase in ambition of the energy reference values needs to be considered per pulp process and paper product grade. The values for pulp have been harmonised in Annexes I and II. Any change in the pulp value needs to be considered from the previous values in three separate Decisions, which sometimes each have different references values.

For chemical pulp, the reference values have dropped from 4000 to 3650 kWh/ADt for fuel and from 800 to 750 kWh/ADt for electricity, a combined reduction of around 9%. For CTMP pulp, the reference values have dropped from 1000 to 800 kWh/ADt for fuel and from 2000 to 1800 kWh/ADt for electricity, a combined reduction of just over 13%.

The previous Tissue Paper criteria had no requirement for fuel consumption (only a single electricity reference value for pulp + paper). This was not considered as an ideal situation due to the complexity of energy systems in the pulp and paper sector and the many overlaps that can exist between these two energy systems. Now EU Ecolabel Tissue Paper and Tissue Products will be compliant with a much more holistic approach to the assessment and verification of specific energy consumption.

14.2.3. Criterion 3: Fibre sourcing

As with the energy use criteria, three diverse approaches have now been harmonised in a single approach. The major difference was between Newsprint Paper (minimum recycled fibre content of 70%) and Copying and Graphic Paper and in Tissue Paper (minimum 50% of virgin fibre content as sustainable certified material). The wording of the assessment and verification text for Tissue Paper was also considered as in need of updating to align with more recently voted and adopted criteria from other product groups having requirements for sustainable forestry.

The single approach sets an ambition level of 70% for any particular combination of sustainable certified virgin fibre and recycled fibre. This approach also aligns with the ambition level of other EU Ecolabel products like furniture and wooden-, cork- and bamboo-based floor coverings and also with current labelling rules for FSC and PEFC.

For Copying and Graphic Paper and Tissue Paper, an increase from 50% to 70% means that, for products with no recycled content at least, there is a need to allocate up to 40% more certified sustainable virgin fibres than previously.

The input of all materials to the process must be covered by suitable Chain of Custody certificates although inputs of Paper for Recycling may alternatively be covered only by EN 643 compliant delivery notes. This increased ambition level should not be an issue for non-integrated paper producers or even integrated paper producers based in countries will high coverage of certified forest areas, but could be a real challenge for integrated producers in southern European countries, especially Portugal and Spain.

The broad term "*mill broke*" has now been split into "*paper machine broke*" and "*broke from converting operations*". The need for this distinction is because both materials can fall under the common term "*mill broke*" in cases where converting lines are present at the same site as the paper machine. While paper machine broke cannot be considered as recycled materials, broke from converting operations should be, as is reflected in the EN 643 definitions for PfR.

14.2.4. Criterion 4: Restricted hazardous substances and mixtures.

The horizontal hazardous substance criteria relating to the REACH Candidate List and CLP classifications have been reworked for graphic paper based on input from stakeholders from the chemicals industry and CBs with experience trying to implement the chemical criteria. It was considered necessary to narrow the scope of the horizontal criterion to only process and functional chemicals used in the paper machine (also during conversion in the case of tissue paper products). The narrowing of the scope was justified because the chemicals used during pulp production are either going to be exempted due to undergoing chemical modification or not remaining in the final product in concentrations exceeding 0.10% (w/w) of the paper. It was also confirming that extending the scope to pulp production for newsprint and copying and graphic paper created excessive workloads and paperwork for both applicants and CBs.

The need for derogations for dyes, pigments, cationic polymers and wet strength agents was considered necessary. For simplicity, these chemicals are not considered to be exempt due to chemical modification. This way, a clear signal can be sent to the supply chain and CBs will interpret the criterion in a more consistent way.

Only relatively minor changes (if any) have been proposed to the remaining specific hazardous substance criteria. For example, an update in reference to relevant legislation for biocidal products, clarifications relating to dye stuff and pigment criteria and the proposed allowance of silicone-based surfactants under certain conditions in line with Nordic Ecolabel experience. The requirement for restricting residual acrylamide monomers has been removed due to pressure from industry, the fact that it does not present a risk to the wider environment when used (is biodegradable) and the fact that nobody has opposed its proposed deletion. The requirement for fragrances in Tissue Paper has been removed because these are now explicitly excluded from the scope. The criterion for lotions has been maintained, but reworded to set a much tighter ambition limit (x10) for individual hazardous substances with restricted CLP classifications than would be applicable under the horizontal CLP criterion 4b.

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List of abbreviations and definitions

ADt	Specific chemical and energy consumption, costs and emissions are expressed as 'per 90 % air dry pulp
Air dry	Air dry tonne of pulp (ADt) meaning dry solids content of 90 %; in case of paper, air dry means paper with 6 % moisture content
BAT-AELs	The range of emission levels obtained under normal operating conditions using a best available technique or a combination of best available techniques, as described in BAT conclusions, expressed as an average over a given period of time, under specified reference conditions (Art 3.12. of Directive 2010/75/EU)
CTMP	Chemithermomechanical pulp
DIP	Deinked pulp – pulp produced from recovered printing paper, e.g. newsprint, through deinking process
ECF	Elemental Chlorine Free. Bleach sequence containing chlorine dioxide but not elementary chlorine gas
GW	Groundwood pulp
Hardwood	Group of wood species including aspen, beech, birch and eucalyptus. The term hardwood is used as opposition to softwood
Kappa number	Measures the amount of residual lignin content in unbleached pulp, determined after pulping and prior to bleaching. The lower the Kappa number, the less associated lignin. The kappa number is dimensionless
Kraft pulp	Chemical pulp which is manufactured using sodium sulphide as the main cooking chemical. Wood chips are digested in an alkaline cooking liquor, an aqueous solution of sodium hydroxide and sodium sulphide (white liquor)
Lime kiln	Unit in the kraft recovery cycle. In this lime kiln, the lime mud is reburnt to lime: $CaCO_{3\ (s)} + \text{heat} \rightarrow CaO_{(s)} + CO_2$
LWC	Light-weight coated paper
Mechanical pulp	Papermaking pulp made entirely by mechanical means from various raw materials, i.e. by grinding wood against an abrasive surface (groundwood pulp) or by processing wood chips or sawdust through a refiner (refiner mechanical pulp). Mechanical pulp contains a considerable amount of non-cellulosic compounds
MWC	Medium-weight coated paper
Pulping	Process of converting raw fibre (e.g. wood) or recycled fibre to a pulp usable in papermaking
RCF	Recycled fibre; pulp obtained from processing paper for recycling
SC	Supercalendered paper
SGW	Stone groundwood (pulp)
Softwood	Wood from conifers including pine and spruce. The term softwood is used as opposition to hardwood
Sulphite pulp	Chemical pulp where various sulphites or bisulphites are used as the main cooking chemical
TCF	Totally Chlorine Free. Bleaching of pulp without using chlorine compound chemicals
TMP	Thermomechanical pulp
TOC	Total Organic Carbon; alternative measurement for COD. Analytical method used to determine the content of organics in a sampling of waste water
Yield	Amount of useful fibre after pulping and/or bleaching or deinking, expressed as a percentage of the useable fibre in relation to the raw material input.

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