Development of European Ecolabel and Green Public Procurement Criteria for Imaging Equipment

Working Document Annex
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Imaging Equipment
Draft criteria proposal
And Technical Report
Version 1.1

JRC
EUROPEAN COMMISSION

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Institute for Prospective Technological Studies

ANNEX 1

Herein, is presented an excerpt of the Ecodesign Preparatory Study on Imaging Equipment [2] in which are presented:

- Inventory data for the investigated case studies
- Findings of the environmental assessment

Table A1. Material and life cycle specific inputs for the base case V1

Table . Life Cycle Impact (per unit) of Base_Case_V1_EP-Copier_MFD-mono

Nr	Life cycle Impact per product:	Date	Author
0	Base_Case_V1_EP-Copier_MFD-mono	0	0

Life Cycle phases -->		PRODUCTION			DISTRI.	USE	END-OF-LIFE*			TOTAL
Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
Materials	unit									
1 Bulk Plastics	g			15228			9255	5908	15228	0
2 TecPlastics	g			5406			3784	1622	5406	0
3 Ferro	g			39141			1957	37184	39141	0
4 Non-ferro	g			1834			92	1742	1834	0
5 Coating	g			0			0	0	0	0
6 Electronics	g			2485			1848	637	2485	0
7 Misc.	g			6048			302	5745	6048	0
Total weight	g			68141			17243	50899	68141	0

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	6	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	250	kWh	250
213	On-mode: No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour		kWh	0
215	Standby-mode: No. Of hours / year		#	
216	Off-mode: Consumption per hour		kWh	0
217	Off-mode: No. Of hours / year		#	
	TOTAL over Product Life	1,50	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	439	kg/ year	57-Office paper
223	Auxilliary material 2 (Click & select)	1,758	kg/ year	79-Toner
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	3407	5%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	13681	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	5590	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	373	2%	4
235	Plastics: Materials Recycling (please edit% only)	5218	28%	4
236	Plastics: Thermal Recycling (please edit% only)	13044	70%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	637	YES	98
238	Metals & IV Glass & Misc. (95% Recycling)	45822		fixed

Table A2. Material and life cycle specific inputs for the base case V2

Table . Life Cycle Impact (per unit) of Base Case V2 - MFD - Copier Color

Nr	Life cycle Impact per product:	Date	Author
0	Base Case V2 - MFD - Copier Color	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			**26262**			18383	7878	**26262**	**0**
2	TecPlastics	g			**17422**			12196	5227	**17422**	**0**
3	Ferro	g			**75416**			3771	71646	**75416**	**0**
4	Non-ferro	g			**7636**			382	7254	**7636**	**0**
5	Coating	g			**0**			0	0	**0**	**0**
6	Electronics	g			**2460**			1738	722	**2460**	**0**
7	Misc.	g			**14250**			712	13537	**14250**	**0**
	Total weight	g			**143446**			37182	106264	**143446**	**0**

Pos nr	USE PHASE Description		unit	Subtotals
211	**Product Life in years**	**6**	years	
	Electricity			
212	**On-mode: Consumption per hour, cycle, setting, etc.**	370	kWh	**370**
213	**On-mode: No. Of hours, cycles, settings, etc. / year**	1	#	
214	**Standby-mode: Consumption per hour**	0	kWh	**0**
215	**Standby-mode: No. Of hours / year**		#	
216	**Off-mode: Consumption per hour**	0	kWh	**0**
217	**Off-mode: No. Of hours / year**		#	
	TOTAL over Product Life	**2,22**	**MWh (=000 kWh)**	**65**
	Heat			
218	**Avg. Heat Power Output**	0	kW	
219	**No. Of hours / year**	0	hrs.	
220	**Type and efficiency (Click & select)**			**85-not applicable**
	TOTAL over Product Life	**0,00**	**GJ**	
	Consumables (excl. spare parts)			**material**
221	**Water**	0	m^3/year	**83-Water per m3**
222	**Auxilliary material 1 (Click & select)**	439	kg/ year	**57-Office paper**
223	**Auxilliary material 2 (Click & select)**	2,636	kg/ year	**79-Toner**
224	**Auxilliary material 3 (Click & select)**	0	kg/ year	**85-None**

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	**Refrigerant in the product (Click & select)**	0	g	**1-none**
228	**Percentage of fugitive & dumped refrigerant**	0%		
229	**Mercury (Hg) in the product**	0	g Hg	
230	**Percentage of fugitive & dumped mercury**	0%		
	Disposal: Environmental Costs perkg final product			
231	**Landfill (fraction products not recovered) in g en %**	7172	5%	**88-fixed**
232	**Incineration (plastics & PWB not re-used/recycled)**	31301	g	**91-fixed**
233	**Plastics: Re-use & Recycling ("cost"-side)**	13105	g	**92-fixed**
	Re-use, Recycling Benefit	**in g**	**% of plastics fraction**	
234	**Plastics: Re-use, Closed Loop Recycling (please edit%)**	874	2%	**4**
235	**Plastics: Materials Recycling (please edit% only)**	12232	28%	**4**
236	**Plastics: Thermal Recycling (please edit% only)**	30579	70%	**72**
237	**Electronics: PWB Easy to Disassemble ? (Click&select)**	722	**YES**	**98**
238	**Metals & TV Glass & Misc.** (95% Recycling)	93403		**fixed**

Table A3. Material and life cycle specific inputs for the base case V3

Table . Life Cycle Impact (per unit) of Base Case_V3_EP-Printer-SFD-mono

Nr	Life cycle Impact per product:	Date	Author
0	Base Case_V3_EP-Printer-SFD-mono		0 vhk

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			4613			3690	923	4613	0
2	TecPlastics	g			5307			4245	1061	5307	0
3	Ferro	g			7280			364	6925	7280	0
4	Non-ferro	g			807			40	767	807	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			823			461	362	823	0
7	Misc.	g			4265			213	4052	4265	0
	Total weight	g			23104			9015	14089	23104	0

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	6	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	270	kWh	270
213	On-mode. No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. Of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. Of hours / year	0	#	
	TOTAL over Product Life	1,62	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	666	kg/ year	57-Office paper
223	Auxilliary material 2 (Click & select)	2,662	kg/ year	79-Toner
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	1155	5%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	8297	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	1984	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	198	2%	4
235	Plastics: Materials Recycling (please edit% only)	1786	18%	4
236	Plastics: Thermal Recycling (please edit% only)	7936	80%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	362	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	11838		fixed

Table A4. Material and life cycle specific inputs for the base case V4

Table . Life Cycle Impact (per unit) of Base Case_V4_EP-Printer-SFD-color

Nr	Life cycle Impact per product:	Date	Author
0	Base Case_V4_EP-Printer-SFD-color	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf	Total	BUTION		Disposal	Recycl	Total	
	Materials	unit									
1	Bulk Plastics	g			14998			11999	3000	14998	0
2	TecPlastics	g			2424			1939	485	2424	0
3	Ferro	g			15901			795	15106	15901	0
4	Non-ferro	g			1619			81	1538	1619	0
5	Coating	g			2			0	2	2	0
6	Electronics	g			1500			1179	300	1500	0
7	Misc.	g			6625			331	6294	6625	0
	Total weight	g			43103			16318	26785	43103	0

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	6	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc	360	kWh	360
213	On-mode: No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. Of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. Of hours / year	0	#	
	TOTAL over Product Life	2,16	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	666	kg/ year	67-Office paper
223	Auxilliary material 2 (Click & select)	3,994	kg/ year	79-Toner
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	2155	5%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	14298	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	3484	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	348	2%	4
235	Plastics: Materials Recycling (please edit% only)	3136	18%	4
236	Plastics: Thermal Recycling (please edit% only)	13938	80%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	360	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	23712		fixed

Table A5. Material and life cycle specific inputs for the base case V5

Table . Life Cycle Impact (per unit) of Base Case V5_IJ-Printer-MFD-Personal

Nr	Life cycle Impact per product:	Date	Author
0	Base Case V5_IJ Printer MFD Personal	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	unit									
1	Bulk Plastics	g			4453			4008	445	4453	0
2	TecPlastics	g			489			440	49	489	0
3	Ferro	g			1929			96	1832	1929	0
4	Non-ferro	g			293			15	279	293	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			478			336	142	478	0
7	Misc	g			1712			86	1627	1712	0
	Total weight	g			9355			4981	4374	9355	0

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	4	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc	18,28	kWh	18,28
213	On-mode: No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. Of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. Of hours / year	0	#	
	TOTAL over Product Life	0,07	MWh (=000 kWh)	65
	Heat			
218	Avg. Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			85-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	5,2	kg/ year	57-Office paper
223	Auxilliary material 2 (Click & select)	0	kg/ year	85-None
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	468	5%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	4590	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	494	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	99	2%	4
235	Plastics: Materials Recycling (please edit% only)	395	8%	4
236	Plastics: Thermal Recycling (please edit% only)	4448	90%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	142	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	3922		fixed

Table A6. Material and life cycle specific inputs for the base case V6

Table . Life Cycle Impact (per unit) of Base Case V6_IJ-Printer-MFD-Workgroup

Nr	Life cycle Impact per product:	Date	Author
0	Base Case V6_IJ-Printer-MFD-Workgroup	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	unit									
1	Bulk Plastics	g			4453			4008	445	4453	0
2	TecPlastics	g			489			440	49	489	0
3	Ferro	g			1929			193	1736	1929	0
4	Non-ferro	g			293			29	264	293	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			478			336	142	478	0
7	Misc.	g			1712			171	1541	1712	0
	Total weight	g			9355			5177	4177	9355	0

Pos nr	USE PHASE Description		unit	Subtotals
211	Product Life in years	4	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	21,99	kWh	21,99
213	On-mode: No. Of hours, cycles, settings, etc. / year	1	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. Of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. Of hours / year	0	#	
	TOTAL over Product Life	0,09	MWh (=000 kWh)	65
	Heat			
218	Avg Heat Power Output	0	kW	
219	No. Of hours / year	0	hrs.	
220	Type and efficiency (Click & select)			86-not applicable
	TOTAL over Product Life	0,00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	83-Water per m3
222	Auxilliary material 1 (Click & select)	19,5	kg/ year	57-Office paper
223	Auxilliary material 2 (Click & select)	0	kg/ year	85-None
224	Auxilliary material 3 (Click & select)	0	kg/ year	85-None

Pos nr	DISPOSAL & RECYCLING Description		unit	Subtotals
	Substances released during Product Life and Landfill			
227	Refrigerant in the product (Click & select)	0	g	1-none
228	Percentage of fugitive & dumped refrigerant	0%		
229	Mercury (Hg) in the product	0	g Hg	
230	Percentage of fugitive & dumped mercury	0%		
	Disposal: Environmental Costs perkg final product			
231	Landfill (fraction products not recovered) in g en %	935	10%	88-fixed
232	Incineration (plastics & PWB not re-used/recycled)	4590	g	91-fixed
233	Plastics: Re-use & Recycling ("cost"-side)	494	g	92-fixed
	Re-use, Recycling Benefit	in g	% of plastics fraction	
234	Plastics: Re-use, Closed Loop Recycling (please edit%)	99	2%	4
235	Plastics: Materials Recycling (please edit% only)	395	8%	4
236	Plastics: Thermal Recycling (please edit% only)	4448	90%	72
237	Electronics: PWB Easy to Disassemble ? (Click&select)	142	YES	98
238	Metals & TV Glass & Misc. (95% Recycling)	3922		fixed

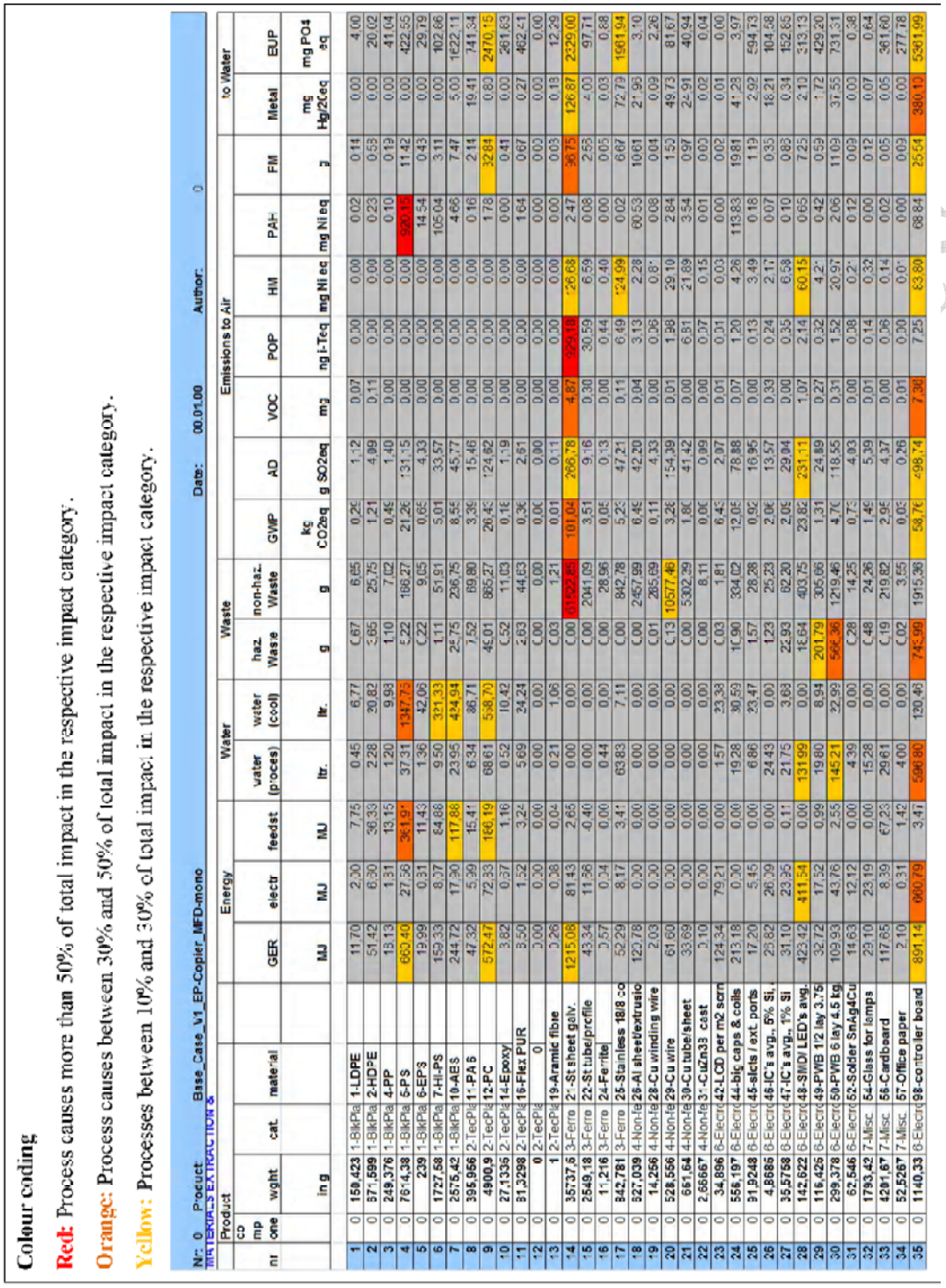
Table A7. Environmental assessment from MEEuP method for the base case V1

Table . Life Cycle Impact (per unit) of Base_Case_V1_EP-Copier_MFD-mono (incl. Paper)

Nr	Life cycle Impact per product:	Date	Author
0	Base_Case_V1_EP-Copier_MFD-mono (incl. Paper)	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	unit									
1	Bulk Plastics	g			13228			9259	3968	13228	0
2	TecPlastics	g			5406			3784	1622	5406	0
3	Ferro	g			39141			1957	37184	39141	0
4	Non-ferro	g			1834			92	1742	1834	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			2485			1848	637	2485	0
7	Misc.	g			6048			302	5745	6048	0
	Total weight	g			68141			17243	50899	68141	0
	Other Resources & Waste							debet	see notel credit		
8	Total Energy (GER)	MJ	5361	1498	6859	510	121708	1190	1024	165	129243
9	of which, electricity (in primary MJ)	MJ	1559	807	2367	1	31582	0	95	-95	33855
10	Water (process)	ltr	1243	27	1270	0	201662	0	81	-81	202851
11	Water (cooling)	ltr	3095	424	3520	0	42895	0	129	-129	46286
12	Waste, non-haz./ landfill	g	89120	4317	93437	272	199787	4195	295	3900	296307
13	Waste, hazardous/ incinerated	g	1666	5	1671	5	1293	13681	96	13585	16555
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	307	85	392	32	2186	89	60	28	2637
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	1959	382	2341	95	17395	182	132	50	19881
17	Volatile Organic Compounds (VOC)	g	15	4	19	7	539	4	2	2	567
18	Persistent Organic Pollutants (POP)	ng I-Teq	992	0	992	2	253	29	1	28	1275
19	Heavy Metals	mg Ni eq.	499	1	500	14	703	323	9	313	1530
	PAHs	mg Ni eq.	1304	4	1308	18	78	0	9	-9	1394
20	Particulate Matter (PM, dust)	g	246	68	314	1156	4537	1632	6	1626	7632
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	810	1	811	0	229	97	42	55	1095
22	Eutrophication	g PO4	19	2	21	0	13931	6	1	4	13956
23	Persistent Organic Pollutants (POP)	ng I-Teq	negligible								

Table A8. Detailed environmental impact assessment of input materials for the base case V1



Colour coding

Red: Process causes more than 50% of total impact in the respective impact category.

Orange: Process causes between 30% and 50% of total impact in the respective impact category.

Yellow: Processes between 10% and 30% of total impact in the respective impact category.

Nr: 0 Product: Base_Case_V1_EP-Copier_MFD-mono Date: 00.01.00 Author: 0

	Product				Energy			Water		Waste			Emissions to Air							to Water	
nr	comp one	wght in g	cat.	material	GER MJ	electr MJ	feedst MJ	water (proces) ltr.	water (cool) ltr.	haz. Waste g	non-haz. Waste g	GWP kg CO2eq	AD g SO2eq	VOC mg	POP ng i-Teq	HM mg Ni eq	PAH mg Ni eq	FM g	Metal mg Hg/2eq	EUP mg PO4 eq
1	0	150,423	1-BkPla	1-LDPE	11 70	2,30	7,75	0,45	6,77	0,67	6,65	0,29	1,12	0,07	0,00	0,00	0,00	0,02	0,11	4,00
2	0	571,599	1-BkPla	2-HDPE	51,42	6,30	38,33	2,28	20,82	3,85	25,75	1,21	4,09	0,11	0,00	0,00	0,23	0,58	0,03	20,02
3	0	249,376	1-BkPla	4-PP	18,13	1,31	13,15	1,20	9,93	1,10	7,02	0,45	1,40	0,00	0,00	0,00	0,10	0,19	0,00	41,04
4	0	764,38	1-BkPla	5-PS	660,40	27,56	361,91	37,31	1347,75	5,22	166,27	21,26	131,15	0,00	0,00	0,00	920,15	11,42	0,03	422,55
5	0	239	1-BkPla	6-EPS	19,99	0,31	11,43	1,36	42,06	0,22	9,05	0,65	4,33	0,00	0,00	0,00	14,54	0,43	0,00	29,79
6	0	1727,58	1-BkPla	7-HI-PS	159,33	8,07	84,88	9,50	321,33	1,11	51,91	5,01	33,57	0,00	0,00	0,00	105,04	3,11	0,00	102,86
7	0	2575,42	1-BkPla	10-ABS	244,72	17,30	117,88	23,95	424,64	28,75	236,75	8,55	45,77	0,00	0,00	0,00	4,66	7,47	5,03	1622,11
8	0	395,956	2-TecPla	11-PA 6	47,32	5,99	15,41	6,34	86,71	7,52	69,80	3,39	15,46	0,00	0,00	0,00	0,16	2,14	19,41	741,54
9	0	4900,9	2-TecPla	12-PC	572,47	72,33	166,19	68,61	538,70	45,01	885,27	26,43	124,62	0,00	0,00	0,00	1,78	32,84	0,80	2470,15
10	0	27,1336	2-TecPla	14-Epoxy	3,82	0,37	1,16	0,52	10,42	0,52	11,03	0,18	1,19	0,00	0,00	0,00	0,41	0,03	0,27	261,63
11	0	31,3298	2-TecPla	16-Flex PUR	3,50	1,52	3,24	5,69	24,24	2,63	44,63	0,36	2,61	0,00	0,00	0,00	1,64	0,67	0,27	462,41
12	0	0	2-TecPla	0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0	1	2-TecPla	19-Aramic fibre	0,26	0,08	0,04	0,21	1,06	0,03	1,21	0,01	0,11	0,00	0,00	0,00	0,00	0,03	0,13	12,29
14	0	35737,6	3-Ferro	21-St sheet galv.	1215,06	81,43	2,65	0,00	0,00	0,00	51922,85	101,04	266,78	4,87	329,18	26,68	2,47	36,75	126,87	2229,00
15	0	2549,18	3-Ferro	22-St tube/profile	43,34	11,56	0,40	0,00	0,00	0,00	2041,09	3,51	9,16	0,30	30,59	6,59	0,08	2,53	4,00	97,11
16	0	11,216	3-Ferro	24-Ferrite	0,57	0,04	0,00	0,44	0,00	0,00	28,96	0,05	0,13	0,00	0,44	0,40	0,00	0,05	0,03	0,88
17	0	842,781	3-Ferro	25-Stainless 18/8 co	52,29	8,17	3,41	63,83	7,11	0,00	842,78	5,23	47,21	0,11	6,49	124,99	0,02	6,67	72,79	1561,94
18	0	527,039	4-Non-fe	26-Al sheet/extrusio	120,78	0,30	0,00	0,00	0,00	0,00	2457,99	6,49	42,20	0,04	3,13	2,28	60,53	10,61	21,96	3,10
19	0	14,256	4-Non-fe	28-Cu winding wire	2,03	0,20	0,00	0,00	0,00	0,01	265,69	0,11	4,33	0,00	0,06	0,87	0,08	0,04	0,09	2,26
20	0	528,556	4-Non-fe	29-Cu wire	61,60	0,30	0,00	0,00	0,00	0,13	10577,46	3,26	154,39	0,01	1,98	29,10	2,84	1,53	49,73	81,67
21	0	661,64	4-Non-fe	30-Cu tube/sheet	33,69	0,30	0,00	0,00	0,00	0,00	5302,29	1,80	41,42	0,00	6,81	21,89	3,54	0,97	24,91	40,94
22	0	2,65667	4-Non-fe	3-CuZn33 cast	0,10	0,20	0,00	0,00	0,00	0,00	8,11	0,00	0,09	0,00	0,07	0,15	0,01	0,03	0,02	0,04
23	0	34,896	6-Electr	42-LCD per m2 scrn	124,34	79,21	0,00	1,57	23,38	0,03	1,81	6,43	2,07	0,01	0,01	0,03	0,00	0,02	0,01	0,00
24	0	556,197	6-Electr	44-big caps & coils	213,18	0,30	0,00	19,28	80,59	10,90	334,02	12,05	78,88	0,07	1,20	4,26	113,83	19,81	41,28	3,97
25	0	91,9248	6-Electr	45-slots / ext. ports	17,20	5,45	0,00	6,66	23,47	1,57	28,28	0,92	16,95	0,00	0,13	3,49	0,18	1,13	2,92	594,13
26	0	4,8885	6-Electr	46-IC's avg., 5% Si,	23,82	26,79	0,00	24,43	0,00	1,23	25,23	2,06	13,57	0,33	0,24	2,17	0,07	0,35	18,21	104,58
27	0	35,5758	6-Electr	47-IC's avg., 1% Si	31,10	23,95	0,11	21,75	3,63	22,93	82,20	2,06	29,04	0,00	0,35	6,58	0,10	0,83	0,34	152,85
28	0	142,622	6-Electr	48-SMD/ LED's avg.	423,42	411,54	0,00	131,99	0,00	16,84	403,75	23,82	231,11	1,07	2,14	60,15	0,65	7,25	2,13	313,13
29	0	115,425	6-Electr	49-PWB 12 lay 3,75	32,72	17,52	0,99	19,80	8,94	201,79	305,66	1,31	24,89	0,27	0,32	4,27	0,42	0,59	1,72	429,20
30	0	299,378	6-Electr	50-PWB 6 lay 4,5 kg	109,93	43,76	2,55	145,21	32,99	566,36	1219,46	4,70	118,55	0,31	1,52	20,97	2,06	11,09	37,55	731,31
31	0	62,546	6-Electr	52-Solder SnAg4Cu	14,63	12,12	0,00	4,39	0,00	0,28	14,25	0,73	4,03	0,00	0,08	0,21	0,12	0,09	0,03	0,38
32	0	1793,42	7-Misc.	54-Glass for lamps	29,10	23,19	0,00	15,28	0,00	0,48	24,36	1,45	5,39	0,01	0,14	0,32	0,00	0,12	0,07	0,64
33	0	4291,67	7-Misc.	56-Cardboard	117,65	8,39	67,23	29,61	0,00	0,19	219,82	2,95	4,37	0,00	0,06	0,14	0,02	0,05	0,05	361,60
34	0	52,5267	7-Misc.	57-Office paper	2,10	0,31	1,42	4,00	0,00	0,02	3,55	0,03	0,26	0,01	0,00	0,01	0,00	0,00	0,00	277,78
35	0	1140,33	8-Electr	98-controller board	891,14	660,79	3,41	596,80	120,46	745,99	1915,36	58,76	498,74	7,38	7,25	83,80	68,84	25,54	380,13	5361,99

Table A9. Environmental assessment from MEEuP method for the base case V2 (including paper)

Table . Life Cycle Impact (per unit) of Base Case V2 - MFD - Copier Color (with paper)

Nr	Life cycle impact per product:							Date	Author		
0	Base Case V2 - MFD - Copier Color (with paper)								0 0		
	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			26262			18383	7878	26262	0
2	TecPlastics	g			17422			12196	5227	17422	0
3	Ferro	g			75416			3771	71646	75416	0
4	Non-ferro	g			7636			382	7254	7636	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			2400			1738	722	2400	0
7	Misc.	g			14250			712	13537	14250	0
	Total weight	g			143446			37182	106264	143446	0
	Other Resources & Waste							debet	see note! credit		
8	Total Energy (GER)	MJ	10601	3151	13752	887	129602	2682	2270	412	144654
9	of which, electricity (in primary MJ)	MJ	2376	1790	4166	2	39172	0	133	-133	43207
10	Water (process)	ltr	1880	44	1924	0	202192	0	108	-108	204007
11	Water (cooling)	ltr	6863	894	7757	0	63526	0	286	-286	70997
12	Waste, non-haz./ landfill	g	250571	9448	260019	454	210052	8835	433	8402	478927
13	Waste, hazardous/ incinerated	g	2739	6	2745	9	1489	31301	124	31177	35421
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	585	177	761	54	2530	199	133	67	3412
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	4450	780	5231	164	19414	411	241	170	24979
17	Volatile Organic Compounds (VOC)	g	22	5	26	13	543	8	3	5	587
18	Persistent Organic Pollutants (POP)	ng i-Teq	1967	0	1967	3	326	62	1	61	2357
19	Heavy Metals	mg Ni eq.	1234	1	1235	23	908	726	11	715	2881
	PAHs	mg Ni eq.	1914	4	1919	30	99	0	11	-11	2036
20	Particulate Matter (PM, dust)	g	483	131	614	2106	4618	3687	11	3677	11015
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	1210	1	1211	1	287	218	48	170	1669
22	Eutrophication	g PO4	46	3	48	0	13932	12	2	11	13991
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Table A10. Environmental assessment from MEEuP method for the base case V2 (excluding paper)

Table . Life Cycle Impact (per unit) of Base Case V2 - MFD - Copier Color (excl. Paper)

Nr	Life cycle impact per product:							Date	Author		
0	Base Case V2 - MFD - Copier Color (excl. Paper)								0 0		
	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			26262			18383	7878	26262	0
2	TecPlastics	g			17422			12196	5227	17422	0
3	Ferro	g			75410			3771	71640	75410	0
4	Non-ferro	g			7636			382	7254	7636	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			2460			1738	722	2460	0
7	Misc.	g			14250			712	13537	14250	0
	Total weight	g			143446			37182	106264	143446	0
	Other Resources & Waste							debet	see note credit		
8	Total Energy (GER)	MJ	10601	3151	13752	887	24242	2682	2270	412	39294
9	of which, electricity (in primary MJ)	MJ	2376	1790	4166	2	23386	0	133	-133	27421
10	Water (process)	ltr	1880	44	1924	0	1632	0	106	-106	3447
11	Water (cooling)	ltr	6963	994	7757	0	63526	0	286	-286	70997
12	Waste, non-haz./ landfill	g	250571	9448	260019	454	32129	8835	433	8402	301004
13	Waste, hazardous/ incinerated	g	2739	6	2745	9	599	31301	124	31177	34530
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	585	177	761	54	1056	199	133	67	1938
15	Ozone Depletion, emissions	mg R-11 eq				negligible					
16	Acidification, emissions	g SO2 eq.	4450	780	5231	164	6187	411	241	170	11752
17	Volatile Organic Compounds (VOC)	g	22	5	26	13	10	8	3	5	54
18	Persistent Organic Pollutants (POP)	ng I-Teq	1967	0	1967	3	215	62	1	61	2246
19	Heavy Metals	mg Ni eq.	1234	1	1235	23	618	726	11	715	2591
	PAHs	mg Ni eq.	1014	4	1019	30	65	0	11	-11	2002
20	Particulate Matter (PM, dust)	g	483	131	614	2106	245	3687	11	3677	6642
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	1210	1	1211	1	178	219	49	170	1560
22	Eutrophication	g PO4	46	3	48	0	3	12	2	11	62
23	Persistent Organic Pollutants (POP)	ng I-Teq				negligible					

Table A11. Detailed environmental impact assessment of input materials for the base case V2

Colour coding

Red: Process causes more than 50% of total impact in the respective impact category.

Orange: Process causes between 30% and 50% of total impact in the respective impact category

Yellow: Processes between 10% and 30% of total impact in the respective impact category.

Nr: 0 Product: Base Case V2 - MFD - Copier Color Date: 00.01.00 Author: 0

MATERIALS EXTRACTION & PRODUCTION

Product					Energy			Water		Waste		Emissions to Air							to Water	
nr	comp	wght	cat	material	GER	electr	feedst	water (proces)	water (cool)	haz. Waste	non-haz. Waste	GWP	AD	VOC	POP	HM	PAH	PM	Metal	EUP
		in g			MJ	MJ	MJ	ltr.	ltr.	g	g	kg CO2eq	g SO2eq	mg	ng i-Teq	mg Ni eq	mg Ni eq	g	mg Hg/20eq	mg PO4 eq
1	0	298,772662	1-BlkPlas	1-LDPE	23,24	3,98	15,40	0,90	13,44	1,33	13,20	0,57	2,22	0,15	0,00	0,00	0,04	0,27	0,00	7,95
2	0	1980,53695	1-BlkPlas	2-HDPE	151,63	19,47	107,15	5,73	61,40	10,77	75,94	3,58	12,07	0,32	0,00	0,00	0,68	1,70	0,00	59,05
3	0	169,0009	1-BlkPlas	4-PP	12,28	1,23	8,91	0,81	6,76	0,75	4,76	0,33	0,95	0,00	0,00	0,00	0,06	0,13	0,00	27,81
4	0	10214,8291	1-BlkPlas	5-PS	886,93	36,98	485,51	50,05	1808,02	7,01	223,05	28,51	175,95	0,00	0,00	0,00	1234,39	15,32	0,00	566,85
5	0	6184,68689	1-BlkPlas	6-EPS	517,41	20,90	295,69	35,25	1088,50	5,75	234,10	16,71	112,15	0,00	0,00	0,00	376,30	11,13	0,00	770,77
6	0	94,5133896	1-BlkPlas	8-PVC	5,35	1,05	2,17	1,04	5,86	0,47	6,34	0,20	1,42	0,00	0,00	0,00	0,00	0,27	0,27	29,63
7	0	7319,27016	1-BlkPlas	10-ABS	695,48	50,87	335,00	68,07	1207,68	73,19	672,84	24,30	130,06	0,00	0,00	0,00	13,23	21,23	14,20	4609,93
8	0	880,020719	2-TecPla	11-PA 6	105,17	13,31	34,24	14,08	192,72	16,72	155,12	7,53	34,36	0,01	0,00	0,00	0,36	4,75	43,14	1647,65
9	0	14990,2694	2-TecPla	12-PC	1751,01	222,76	569,48	209,86	1708,89	149,90	2646,59	80,84	381,17	0,00	0,00	0,00	5,44	100,43	2,46	7555,39
10	0	89,9049871	2-TecPla	14-Epoxy	12,65	2,21	3,83	1,71	34,62	1,71	36,56	0,59	3,95	0,00	0,00	0,00	0,01	1,35	0,00	867,67
11	0	995,832754	2-TecPla	15-Rigid PUR	103,82	17,39	38,51	59,75	299,75	19,51	425,39	4,16	30,86	0,00	0,00	0,00	20,11	7,33	43,02	3172,52
12	0	466,480613	2-TecPla	16-Flex PUR	48,73	8,73	18,56	32,65	139,01	15,11	255,99	2,09	14,98	0,00	0,00	0,00	9,41	3,84	1,56	2652,22
13	0	72588,3738	3-Ferro	21-St sheet galv.	2468,00	165,39	5,39	0,00	0,00	0,00	124962,34	205,23	541,88	9,90	1887,30	257,30	5,03	196,52	257,70	4730,55
14	0	5,98114795	3-Ferro	24-Ferrite	0,30	0,02	0,00	0,24	0,00	0,00	15,44	0,03	0,07	0,00	0,23	0,21	0,00	0,02	0,01	0,47
15	0	2822,10803	3-Ferro	25-Stainless 18/8 coil	175,09	27,35	11,42	213,73	23,80	0,00	2822,11	17,51	158,10	0,38	21,73	418,53	0,08	22,33	243,74	6569,67
16	0	1587,14805	4-Non-fe	26-Al sheet/extrusion	306,72	0,00	0,00	0,00	0,00	0,00	6221,62	16,42	106,82	0,10	7,92	5,77	153,22	26,85	55,58	7,85
17	0	179,333333	4-Non-fe	27-Al diecast	9,89	0,00	0,00	0,00	0,00	0,00	134,50	0,64	2,80	0,01	6,01	0,15	3,17	0,73	1,16	0,22
18	0	3910,9319	4-Non-fe	28-Cu winding wire	558,17	0,00	0,00	0,00	0,00	3,12	78375,08	28,81	1188,28	0,12	15,53	221,04	21,63	11,83	25,30	618,71
19	0	954,569798	4-Non-fe	29-Cu wire	111,26	0,00	0,00	0,00	0,00	0,23	19102,85	5,92	278,83	0,01	3,57	52,56	5,14	2,71	89,82	147,50
20	0	1004,00895	4-Non-fe	30-Cu tube/sheet	51,13	0,00	0,00	0,00	0,00	0,00	8046,13	2,74	62,85	0,00	10,33	33,22	5,38	1,47	37,80	62,13
21	0	82,3333333	6-Electro	42-LCD per m2 scrn	293,37	186,90	0,00	3,71	55,16	0,08	4,28	15,18	4,87	0,03	0,02	0,06	0,01	0,05	0,02	0,00
22	0	0	6-Electro	44-big caps & coils	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
23	0	165,882796	6-Electro	45-slots / ext. ports	31,03	9,84	0,00	12,38	42,36	2,84	51,04	1,66	30,58	0,00	0,23	6,30	0,32	2,15	5,28	1073,22
24	0	9,71189337	6-Electro	46-IC's avg., 5% Si, Au	53,51	52,04	0,00	43,72	0,00	2,45	50,32	4,11	27,07	0,66	0,47	4,34	0,14	0,71	36,32	208,62
25	0	31,9915816	6-Electro	47-IC's avg., 1% Si	27,97	21,54	0,10	19,56	3,31	20,62	55,93	1,88	26,11	0,00	0,31	5,92	0,09	0,77	0,31	137,45
26	0	274,313167	6-Electro	48-SMD/ LED's avg.	814,40	791,55	0,00	253,86	0,00	35,85	776,56	45,81	444,52	2,05	4,11	115,68	1,24	13,94	4,04	602,25
27	0	706,504649	6-Electro	49-PWB 1/2 lay 3.75kg	198,57	106,35	6,03	120,13	54,26	1224,55	1854,82	7,93	151,02	1,64	1,91	25,54	2,52	3,59	10,42	2604,49
28	0	280,872833	6-Electro	50-PWB 6 lay 4.5 kg/m	103,13	41,05	2,40	135,24	21,57	531,35	1144,08	4,41	111,22	0,29	1,43	19,68	1,93	10,40	35,23	686,10
29	0	6,13223377	6-Electro	51-PWB 6 lay 2kg/m2	2,99	2,04	0,07	2,47	0,64	26,10	14,32	0,12	1,35	0,00	0,02	0,20	0,02	0,04	2,00	17,45
30	0	1904,51801	7-Misc.	54-Glass for lamps	30,90	24,62	0,00	15,23	0,00	0,51	25,76	1,59	5,72	0,01	0,15	0,34	0,00	0,12	0,08	0,63
31	0	12166,6667	7-Misc.	56-Cardboard	340,67	24,31	194,67	85,75	0,00	0,56	636,52	8,54	12,65	0,01	0,16	0,42	0,05	0,13	0,16	1047,03
32	0	178,368057	7-Misc.	57-Office paper	7,13	1,07	4,82	13,58	0,00	0,06	12,05	0,10	0,90	0,04	0,01	0,02	0,00	0,30	0,01	943,23
33	0	902,307833	6-Electro	98-controller board	705,13	522,86	2,75	472,23	95,32	588,69	1515,56	46,50	394,64	5,82	5,74	66,31	54,47	20,21	300,76	4242,77

Table A12. Environmental assessment from MEEuP method for the base case V3 (including paper)

Table 14: Eco-assessment results from MEEuP EcoReport for Base Case V3 (incl. paper)

Table . Life Cycle Impact (per unit) of Base Case_V3_EP-Printer-SFD-mono (incl. Paper)

Nr	Life cycle Impact per product:	Date	Author
0	Base Case_V3_EP-Printer-SFD-mono (incl. Paper)	0	vhk

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			4613			3690	923	4613	0
2	TecPlastics	g			5307			4245	1061	5307	0
3	Ferro	g			7290			364	6925	7290	0
4	Non-ferro	g			807			40	767	807	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			823			461	362	823	0
7	Misc.	g			4265			213	4052	4265	0
	Total weight	g			23104			9015	14089	23104	0
	Other Resources & Waste							debet	see notel credit		
8	Total Energy (GER)	MJ	2025	631	2656	205	177079	650	545	105	180044
9	of which, electricity (in primary MJ)	MJ	497	322	819	0	41001	0	49	-49	41771
10	Water (process)	ltr	525	13	538	0	305465	0	43	-43	305960
11	Water (cooling)	ltr	1504	172	1077	0	46078	0	49	-49	48300
12	Waste, non-haz./ landfill	g	26265	2025	28290	125	202456	1423	151	1272	322142
13	Waste, hazardous/ incinerated	g	1763	3	1766	2	1795	8298	52	8246	11809
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	102	36	138	14	3012	48	35	14	3177
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	755	166	920	40	24590	98	74	25	25575
17	Volatile Organic Compounds (VOC)	g	3	2	5	2	816	2	1	1	824
18	Persistent Organic Pollutants (POP)	ng i-Teq	190	20	210	1	325	10	0	10	545
19	Heavy Metals	mg Ni eq.	178	47	225	6	942	175	5	170	1344
	PAHs	mg Ni eq.	170	2	172	8	86	0	6	-5	261
20	Particulate Matter (PM, dust)	g	90	31	121	387	6841	866	3	863	8212
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	311	0	311	0	294	54	24	30	635
22	Eutrophication	g PO4	13	1	13	0	21135	3	1	3	21151
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Table A13. Detailed environmental impact assessment of input materials for the base case V3

Colour coding

Red: Process causes more than 50% of total impact in the respective impact category.

Orange: Process causes between 30% and 50% of total impact in the respective impact category.

Yellow: Processes between 10% and 30% of total impact in the respective impact category.

Nr: 0 Product: Base Case_V3_EP-Printer-SFD-mono Date: 00.01.00 Author: vhk

MATERIALS EXTRACTION & PRODUCTION

Product					Energy			Water		Waste		Emissions to Air							to Water	
nr	co mp	wght	cat.	material	GER	electr	feedst	water (proces)	water (cool)	haz. Waste	non-haz. Waste	GWP	AD	VOC	POP	HM	PAH	PM	Metal	EUP
		in g			MJ	MJ	MJ	ltr.	ltr.	g	g	kg CO2eq	g SO2eq	mg	ng i-Teq	mg Ni eq	mg Ni eq	g	mg Hg/20eq	mg PO4 eq
1	0	114,87	1-BlkPlas	1-LDPE	8,94	1,53	5,92	0,34	5,17	0,51	5,08	0,22	0,86	0,06	0,00	0,00	0,02	0,11	0,00	3,06
2	0	366,87	1-BlkPlas	2-HDPE	28,09	3,61	19,85	1,25	11,37	2,00	14,07	0,66	2,24	0,06	0,00	0,00	0,13	0,32	0,00	10,94
3	0	43,433	1-BlkPlas	3-LLDPE	3,21	0,44	2,06	0,10	5,04	0,15	1,33	0,08	0,26	0,00	0,00	0,00	0,00	0,06	0,00	1,70
4	0	82,183	1-BlkPlas	4-PP	5,97	0,60	4,33	0,39	3,29	0,36	2,31	0,16	0,46	0,00	0,00	0,00	0,03	0,06	0,00	13,52
5	0	851,84	1-BlkPlas	5-PS	73,88	3,08	40,45	4,17	150,77	0,58	18,60	2,38	14,67	0,00	0,00	0,00	102,94	1,28	0,00	47,27
6	0	3,7333	1-BlkPlas	6-EPS	0,31	0,01	0,18	0,02	0,66	0,00	0,14	0,01	0,07	0,00	0,00	0,00	0,23	0,01	0,00	0,47
7	0	191,25	1-BlkPlas	8-PVC	10,83	2,12	4,39	2,10	11,86	0,96	12,83	0,41	2,87	0,00	0,00	0,00	0,01	0,55	0,54	60,05
8	0	4,0667	1-BlkPlas	9-SAN	0,36	0,02	0,19	0,02	0,66	0,02	0,13	0,01	0,06	0,00	0,00	0,00	0,00	0,01	0,00	1,14
9	0	2954,5	1-BlkPlas	10-ABS	280,74	20,53	135,23	27,48	487,49	29,55	271,60	9,81	52,50	0,00	0,00	0,00	5,34	3,57	5,73	1860,87
10	0	626,39	2-TecPla	11-PA 6	74,86	9,48	24,37	10,02	137,18	11,90	110,41	5,36	24,46	0,01	0,00	0,00	0,25	3,38	30,71	1172,77
11	0	4219,4	2-TecPla	12-PC	492,86	62,70	160,29	59,07	481,01	42,19	744,95	22,75	107,29	0,00	0,00	0,00	1,53	28,27	0,69	2126,64
12	0	47,95	2-TecPla	13-PMMA	5,28	0,63	2,01	0,47	1,25	0,07	5,02	0,29	2,09	0,00	0,00	0,00	0,00	0,24	0,13	99,16
13	0	38,816	2-TecPla	14-Epoxy	5,46	0,95	1,66	0,74	14,91	0,74	15,78	0,26	1,71	0,00	0,00	0,00	0,00	0,58	0,00	374,57
14	0	50,847	2-TecPla	15-Rigid PUR	5,30	0,89	1,97	3,05	15,30	1,00	21,72	0,21	1,58	0,00	0,00	0,00	1,03	0,37	2,20	161,99
15	0	139,26	2-TecPla	16-Flex PUR	14,55	2,61	5,54	9,75	41,50	4,51	76,42	0,62	4,47	0,00	0,00	0,00	2,81	1,15	0,46	791,79
16	0	184,13	2-TecPla	18-E-glass fibre	12,12	3,88	1,99	10,00	49,96	1,30	57,30	0,62	5,37	0,00	0,00	0,00	0,01	1,50	8,72	580,26
17	0	6506,7	3-Ferro	21-St sheet galv.	221,23	14,83	0,48	0,00	0,00	0,00	11201,34	18,40	48,57	0,89	169,17	23,06	0,45	17,62	23,10	424,04
18	0	212,55	3-Ferro	22-St tube/profile	3,61	0,97	-0,03	0,00	0,00	0,00	170,18	0,29	0,76	0,02	2,55	0,55	0,01	0,21	0,33	8,15
19	0	3,4667	3-Ferro	23-Cast iron	0,03	0,00	0,00	0,00	0,01	0,00	1,09	0,00	0,01	0,00	0,02	0,01	0,00	0,05	0,00	0,09
20	0	108,99	3-Ferro	24-Ferrite	5,51	0,37	0,01	4,29	0,00	0,00	281,45	0,46	1,22	0,02	4,25	3,92	0,00	0,44	0,26	8,57
21	0	458,03	3-Ferro	25-Stainless 18/8 coil	28,42	4,44	1,85	34,69	3,86	0,00	458,03	2,84	25,66	0,06	3,53	67,93	0,01	3,62	39,56	1066,27
22	0	213,01	4-Non-fe	26-Al sheet/extrusion	41,03	0,00	0,00	0,00	0,00	0,00	834,99	2,20	14,34	0,01	1,06	0,77	20,56	3,60	7,46	1,05
23	0	388,64	4-Non-fe	28-Cu winding wire	55,47	0,00	0,00	0,00	0,00	0,31	7788,38	2,86	118,08	0,01	1,54	21,97	2,15	1,18	2,51	61,48
24	0	45,633	4-Non-fe	27-Al diecast	2,52	0,00	0,00	0,00	0,00	0,00	34,23	0,16	0,71	0,00	1,53	0,04	0,81	0,18	0,30	0,06
25	0	96,06	4-Non-fe	29-Cu wire	11,20	0,00	0,00	0,00	0,00	0,02	1922,35	0,60	28,06	0,00	0,36	5,29	0,52	0,27	9,04	14,84
26	0	29,366	4-Non-fe	30-Cu tube/sheet	1,50	0,00	0,00	0,00	0,00	0,00	235,34	0,08	1,84	0,00	0,30	0,97	0,16	0,04	1,11	1,82
27	0	2,6667	4-Non-fe	31-CuZn38 cast	0,10	0,00	0,00	0,00	0,00	0,00	8,11	0,00	0,09	0,00	0,07	0,15	0,01	0,00	0,02	0,04
28	0	31,867	4-Non-fe	32-ZnAl4 cast	0,90	0,00	0,00	0,07	0,00	0,02	48,85	0,04	0,20	0,00	1,91	0,07	0,03	0,04	0,01	0,02
29	0	113,73	6-Electro	44-big caps & coils	43,59	0,00	0,00	3,94	6,25	2,23	68,30	2,46	16,13	0,01	0,25	0,87	23,27	4,05	8,44	0,81
30	0	87,417	6-Electro	45-slots / ext. ports	16,35	5,18	0,00	6,53	22,32	1,49	26,90	0,88	16,12	0,00	0,12	3,32	0,17	1,13	2,78	565,56
31	0	6,3678	6-Electro	46-IC's avg., 5% Si, Au	35,08	34,12	0,00	31,95	0,00	1,60	32,99	2,70	17,75	0,43	0,31	2,84	0,09	0,46	23,82	136,79
32	0	9,1458	6-Electro	47-IC's avg., 1% Si	8,00	6,16	0,03	5,59	0,95	5,90	15,99	0,54	7,46	0,00	0,09	1,69	0,03	0,22	0,09	39,29
33	0	45,821	6-Electro	48-SMD/ LED's avg.	133,66	129,91	0,00	41,66	0,00	5,88	127,45	7,52	72,95	0,34	0,67	18,99	0,20	2,29	0,66	98,84
34	0	65,509	6-Electro	49-PWB 1/2 lay 3.75kg	18,41	9,86	0,56	11,14	5,03	113,54	171,98	0,74	14,00	0,15	0,18	2,37	0,23	0,33	0,97	241,49
35	0	97,312	6-Electro	50-PWB 6 lay 4.5 kg/m	35,73	14,22	0,83	47,20	7,47	184,09	396,38	1,53	38,53	0,10	0,50	6,82	0,67	3,60	12,21	237,71

Table A14. Environmental assessment from MEEuP method for the base case V4 (including paper)

Table . Life Cycle Impact (per unit) of Base Case_V4_EP-Printer-SFD-color (incl. Paper)

Nr	Life cycle Impact per product:	Date	Author
0	Base Case_V4_EP-Printer-SFD-color (incl. Paper)	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			14998			11999	3000	14998	0
2	TecPlastics	g			2424			1939	485	2424	0
3	Ferro	g			15001			795	15106	15001	0
4	Non-ferro	g			1619			81	1538	1619	0
5	Coating	g			2			0	2	2	0
6	Electronics	g			1533			1173	360	1533	0
7	Misc.	g			6625			331	6294	6625	0
	Total weight	g			43103			16318	26785	43103	0
	Other Resources & Waste							debet	see note! credit		
8	Total Energy (GER)	MJ	3525	1103	4628	345	183770	1132	990	142	188884
9	of which, electricity (in primary MJ)	MJ	782	601	1383	1	46094	0	55	-55	48023
10	Water (process)	ltr	865	17	882	0	305876	0	46	-46	306712
11	Water (cooling)	ltr	2788	299	3087	0	62464	0	81	-81	65470
12	Waste, non-haz./ landfill	g	54462	3829	58291	193	300594	2653	172	2481	361559
13	Waste, hazardous/ incinerated	g	1306	3	1309	4	1938	14298	55	14243	17494
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	176	63	239	22	3276	84	64	20	3557
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	1285	280	1565	65	20123	171	113	59	27813
17	Volatile Organic Compounds (VOC)	g	8	3	11	5	818	3	1	2	835
18	Persistent Organic Pollutants (POP)	ng i-Teq	415	44	459	1	386	19	0	18	865
19	Heavy Metals	mg Ni eq.	373	104	477	10	1146	306	5	300	1933
	PAHs	mg Ni eq.	1008	2	1010	12	106	0	5	-5	1123
20	Particulate Matter (PM, dust)	g	140	48	189	730	6029	1509	4	1505	9361
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	460	0	460	0	340	93	24	69	870
22	Eutrophication	g PO4	31	1	32	0	21136	5	1	5	21172
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Table A15. Detailed environmental impact assessment of input materials for the base case V4

Colour coding

Red: Process causes more than 50% of total impact in the respective impact category.

Orange: Process causes between 30% and 50% of total impact in the respective impact category.

Yellow: Processes between 10% and 30% of total impact in the respective impact category.

Nr: 0 Product: Base Case_V4_EP-Printer-SFD-color Date: 00.01.00 Author:)

	Product				Energy			Water		Waste		Emissions to Air							to Water	
nr	com	wght	cat.	material	GER	electr	feedst	water (proces)	water (cool)	haz. Waste	non-haz. Waste	GWP	AD	VOC	POP	HM	PAH	PM	Metal	EUP
		in g			MJ	MJ	MJ	ltr.	ltr.	g	g	kg CO2eq	g SO2eq	mg	ng i-Teq	mg Ni eq	mg Ni eq	g	mg Hg20eq	mg PO4 eq
1	0	1182,2	1-BlkPlas	1-LDPE	91,97	15,73	60,93	3,55	53,20	5,26	52,23	2,24	8,80	0,58	0,00	0,00	0,16	1,09	0,00	31,47
2	0	60,975	1-BlkPlas	2-HDPE	4,67	0,60	3,30	0,21	1,89	0,33	2,34	0,11	0,37	0,01	0,00	0,00	0,02	0,05	0,00	1,82
3	0	1224,9	1-BlkPlas	4-PP	89,04	6,89	64,58	5,88	48,99	5,42	34,46	2,42	6,87	0,02	0,00	0,00	0,47	0,92	0,00	201,56
4	0	6575,7	1-BlkPlas	5-PS	570,31	23,80	312,54	32,22	1163,90	4,51	143,59	18,06	113,26	0,00	0,00	0,00	784,63	9,86	0,00	364,91
5	0	200,55	1-BlkPlas	6-EPS	16,78	0,68	9,59	1,14	35,30	0,19	7,59	0,54	3,64	0,00	0,00	0,00	12,20	0,36	0,00	24,99
6	0	330,07	1-BlkPlas	7-HI-PS	30,44	1,54	16,22	1,82	61,39	0,21	9,92	0,96	6,41	0,00	0,00	0,00	20,07	0,59	0,00	19,65
7	0	226,2	1-BlkPlas	8-PVC	12,81	2,51	5,19	2,49	14,92	1,13	15,18	0,48	3,39	0,00	0,00	0,00	0,01	0,66	0,64	71,03
8	0	505,98	1-BlkPlas	9-SAN	45,32	1,94	23,91	3,09	82,64	2,08	16,00	1,52	7,09	0,00	0,00	0,00	0,20	0,86	0,00	142,46
9	0	4680,6	1-BlkPlas	10-ABS	445,70	32,60	214,69	43,62	773,95	46,91	431,20	15,58	83,35	0,00	0,00	0,00	8,48	13,60	9,10	2954,35
10	0	1258,7	2-TecPlas	11-PA 6	150,43	19,04	48,98	20,14	275,66	13,92	221,88	10,78	49,14	0,01	0,00	0,00	0,51	6,80	81,70	2356,69
11	0	1129,1	2-TecPlas	12-PC	131,89	16,78	42,89	15,81	128,71	11,29	199,34	6,09	28,71	0,00	0,00	0,00	0,41	7,56	0,19	569,07
12	0	3	2-TecPlas	13-PMMA	0,33	0,04	0,13	0,03	0,08	0,00	0,31	0,02	0,13	0,00	0,00	0,00	0,00	0,02	0,01	6,20
13	0	20,85	2-TecPlas	15-Rigid PUR	2,17	0,36	0,81	1,25	6,28	0,41	8,91	0,09	0,65	0,00	0,00	0,00	0,42	0,15	0,90	66,42
14	0	12,43	2-TecPlas	16-Flex PUR	1,30	0,23	0,49	0,87	3,70	0,40	6,82	0,06	0,40	0,00	0,00	0,00	0,25	0,10	0,04	70,67
15	0	14655	3-Ferro	21-St sheet galv.	498,26	33,39	1,09	0,00	0,00	0,00	25228,51	41,43	109,40	2,00	381,00	51,95	1,01	39,68	52,03	955,05
16	0	25,65	3-Ferro	22-St tube/profile	0,44	0,12	0,00	0,00	0,00	0,00	20,54	0,04	0,09	0,00	0,31	0,07	0,00	0,03	0,04	0,98
17	0	171,91	3-Ferro	23-Cast iron	1,72	0,02	-0,01	0,22	0,83	0,00	54,21	0,18	0,56	0,02	1,03	0,34	0,00	2,41	0,15	4,51
18	0	219,01	3-Ferro	24-Ferrite	11,08	0,75	0,02	8,61	0,00	0,00	565,55	0,93	2,44	0,04	8,54	7,87	0,00	0,89	0,52	17,22
19	0	829,99	3-Ferro	26-Stainless 18/8 co	51,49	8,04	3,36	62,86	7,90	0,00	829,99	5,15	45,50	0,11	6,39	123,09	0,02	8,57	71,68	1932,15
20	0	448,38	4-Non-fe	26-Al sheet/extrusi	86,37	0,00	0,00	0,00	0,00	0,00	1757,65	4,64	30,18	0,03	2,24	1,83	43,28	7,58	15,70	2,22
21	0	18,665	4-Non-fe	27-Al diecast	1,03	0,00	0,00	0,00	0,00	0,00	14,00	0,07	0,29	0,00	0,63	0,02	0,33	0,08	0,12	0,02
22	0	297,65	4-Non-fe	28-Cu winding wire	42,48	0,00	0,00	0,00	0,00	0,24	5964,81	2,19	90,43	0,01	1,18	16,82	1,65	0,90	1,93	47,09
23	0	531,83	4-Non-fe	29-Cu wire	61,98	0,00	0,00	0,00	0,00	0,13	10642,90	3,30	155,35	0,01	1,99	29,28	2,86	1,51	50,04	82,18
24	0	291,15	4-Non-fe	30-Cu tube/sheet	14,83	0,00	0,00	0,00	0,00	0,00	2333,31	0,79	18,23	0,00	3,00	9,83	1,56	0,42	10,96	18,02
25	0	22,834	4-Non-fe	31-CuZn38 cast	0,88	0,00	0,00	0,00	0,00	0,01	69,43	0,04	0,80	0,00	0,55	1,30	0,08	0,03	0,20	0,35
26	0	8,8	4-Non-fe	32-ZnAl4 cast	0,25	0,00	0,00	0,02	0,00	0,00	13,49	0,01	0,06	0,00	0,53	0,02	0,01	0,01	0,00	0,01
27	0	2,19	5-Coating	40-Cu/Ni/Cr plating	6,04	5,66	0,00	0,41	3,81	0,13	43,80	0,27	3,67	0,01	0,87	42,38	0,01	0,12	0,34	208,06
28	0	0,015	5-Coating	41-Au/Pt/Pd	3,38	3,04	0,00	0,00	0,00	0,39	2812,57	0,27	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00
29	0	13,95	6-Electro	42-LCD per m2 scr	49,71	31,67	0,00	0,83	9,35	0,01	0,73	2,57	0,83	0,01	0,00	0,01	0,00	0,01	0,00	0,00
30	0	517,59	6-Electro	44-big caps & coils	198,39	0,00	0,00	17,94	28,47	0,15	310,80	11,22	73,40	0,06	1,12	3,96	105,93	18,43	38,42	3,69
31	0	88,239	6-Electro	45-slots / ext. ports	16,51	5,23	0,00	6,59	22,53	1,51	27,15	0,88	16,27	0,00	0,12	3,35	0,17	1,14	2,81	570,88
32	0	19,809	6-Electro	46-IC's avg., 5% Si,	109,14	106,15	0,00	99,38	0,00	4,99	102,64	8,38	55,22	1,34	0,97	8,85	0,29	1,44	74,09	425,52
33	0	19,934	6-Electro	47-IC's avg., 1% Si	17,43	13,42	0,06	12,19	2,96	2,85	34,85	1,17	16,27	0,00	0,20	3,59	0,06	0,48	0,19	85,64
34	0	78,43	6-Electro	48-SMD/ LED's avg.	232,85	226,31	0,00	72,58	0,00	10,25	222,03	13,10	127,09	0,59	1,18	33,08	0,35	3,99	1,15	172,19
35	0	605,13	6-Electro	49-PWB 1/2 lay 3.75	170,07	91,09	5,16	102,89	46,47	1588,80	1588,67	6,79	129,35	1,41	1,64	21,87	2,16	3,07	8,92	2230,76

Table A16. Environmental assessment from MEEuP method for the base case V5 (including paper)

Table . Life Cycle Impact (per unit) of Base Case V5_IJ-MFD-Personal (Incl. Paper)

Nr	Life cycle impact per product:	Date	Author
0	Base Case V5_IJ-MFD-Personal (incl. Paper)	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	**unit**									
1	Bulk Plastics	g			4453			4008	445	4453	0
2	TecPlastics	g			489			440	49	489	0
3	Ferro	g			1929			96	1832	1929	0
4	Non-ferro	g			293			15	279	293	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			478			336	142	478	0
7	Misc.	g			1712			86	1627	1712	0
	Total weight	g			9355			4981	4374	9355	0
	Other Resources & Waste							debet	see note! credit		
8	Total Energy (GER)	MJ	1162	275	1437	91	1614	344	275	69	3211
9	of which, electricity (in primary MJ)	MJ	416	144	560	0	898	0	18	-18	1440
10	Water (process)	ltr	205	5	211	0	1637	0	16	-16	1832
11	Water (cooling)	ltr	958	76	1034	0	2058	0	14	-14	3078
12	Waste, non-haz./ landfill	g	55417	851	56269	70	2858	575	55	520	59717
13	Waste, hazardous/ incinerated	g	385	1	387	1	29	4590	20	4570	4987
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	57	16	73	7	46	26	19	7	132
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	320	71	392	19	306	52	36	16	733
17	Volatile Organic Compounds (VOC)	g	2	1	3	1	5	1	0	0	8
18	Persistent Organic Pollutants (POP)	ng I-Teq	54	6	59	0	6	4	0	4	70
19	Heavy Metals	mg Ni eq.	49	13	62	4	16	93	2	91	172
	PAHs	mg Ni eq.	277	1	278	4	5	0	2	-2	285
20	Particulate Matter (PM, dust)	g	28	13	42	99	39	445	1	444	624
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	107	0	107	0	7	29	9	19	133
22	Eutrophication	g PO4	5	0	5	0	110	2	0	1	117
23	Persistent Organic Pollutants (POP)	ng I-Teq	negligible								

Table A17. Detailed environmental impact assessment of input materials for the base case V5

Colour coding

Red: Process causes more than 50% of total impact in the respective impact category.

Orange: Process causes between 30% and 50% of total impact in the respective impact category.

Yellow: Processes between 10% and 30% of total impact in the respective impact category.

Nr: 0 Product: Base Case V5_IJ-MFD-Personal Date: 10.01.00 Author: 0

PRODUCTION

	Product				Energy			Water		Waste		Emissions to Air							to Water	
nr	com	wght	cat.	material	GER	electr	feedst	water (proces)	water (cool)	haz. Waste	non-haz. Waste	GWP	AD	VOC	POP	HM	PAH	PM	Metal	EUP
		in g			MJ	MJ	MJ	ltr.	ltr.	g	g	kg CO2eq	g SO2eq	mg	ng i-Teq	mg Ni eq	mg Ni eq	g	mg Hg/20eq	mg PO4 eq
1	0	97,863	1-BlkPast	1-LDPE	7,55	1,29	5,00	0,29	4,37	0,43	4,29	0,18	0,72	0,05	0,00	0,00	0,01	0,09	0,00	2,58
2	0	40,845	1-BlkPast	2-HDPE	3,13	0,40	2,21	0,14	1,27	0,22	1,57	0,07	0,25	0,01	0,00	0,00	0,01	0,04	0,00	1,22
3	0	76,207	1-BlkPast	4-PP	5,54	0,55	4,02	0,37	3,05	0,34	2,14	0,15	0,43	0,00	0,00	0,00	0,03	0,06	0,00	12,54
4	0	767,61	1-BlkPast	5-PS	66,57	2,78	36,48	3,76	135,87	0,53	16,16	2,14	13,22	0,00	0,00	0,00	92,76	1,15	0,00	42,60
5	0	51	1-BlkPast	6-EPS	4,27	0,17	2,44	0,29	8,98	0,05	1,93	0,14	0,92	0,00	0,00	0,00	3,10	0,09	0,00	5,36
6	0	2334,5	1-BlkPast	7-HI-PS	215,31	10,90	114,69	12,84	434,22	1,49	70,15	6,77	45,37	0,00	0,00	0,00	141,95	4,20	0,00	139,00
7	0	41,243	1-BlkPast	8-PVC	2,33	0,46	0,95	0,45	2,56	0,21	2,77	0,09	0,62	0,00	0,00	0,00	0,00	0,12	0,12	12,95
8	0	2,6675	1-BlkPast	9-SAN	0,24	0,01	0,13	0,02	0,43	0,01	0,08	0,01	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,75
9	0	1041,7	1-BlkPast	10-ABS	98,99	7,24	47,68	9,69	171,89	10,42	95,76	3,45	18,51	0,00	0,00	0,00	1,88	3,02	2,02	656,10
10	0	211,75	2-TecPlas	11-PA 6	25,31	3,20	8,24	3,39	46,37	4,02	37,33	1,81	8,27	0,00	0,00	0,00	0,09	1,14	10,38	396,46
11	0	84,941	2-TecPlas	12-PC	9,92	1,26	3,23	1,19	9,68	0,85	15,00	0,45	2,16	0,00	0,00	0,00	0,03	0,57	0,01	42,81
12	0	16,648	2-TecPlas	13-PMMA	1,83	0,22	0,70	0,16	0,43	0,02	1,74	0,10	0,73	0,00	0,00	0,00	0,00	0,06	0,05	34,43
13	0	5,87	2-TecPlas	14-Epoxy	0,83	0,14	0,25	0,11	2,25	0,11	2,39	0,04	0,26	0,00	0,00	0,00	0,00	0,09	0,00	56,64
14	0	37,783	2-TecPlas	15-Rigid PUR	3,94	0,66	1,46	2,27	11,37	0,74	16,14	0,15	1,17	0,00	0,00	0,00	0,76	0,26	1,63	120,37
15	0	116,35	2-TecPlas	16-Flex PUR	12,15	2,18	4,63	8,14	34,67	3,77	63,85	0,52	3,74	0,00	0,00	0,00	2,35	0,96	0,39	661,50
16	0	15,655	2-TecPlas	18-E-glass fibr	1,03	0,33	0,17	0,85	4,25	0,11	4,87	0,05	0,46	0,00	0,00	0,00	0,00	0,13	0,74	49,30
17	0	0,0375	2-TecPlas	19-Aramid fibr	0,01	0,00	0,00	0,01	0,04	0,00	0,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,46
18	0	1863,1	3-Ferro	21-St sheet gal	63,34	4,24	0,14	0,00	0,00	0,00	3207,28	5,27	13,91	0,25	48,44	6,60	0,13	5,04	8,61	121,41
19	0	38,865	3-Ferro	24-Ferrite	1,93	0,13	0,00	1,50	0,00	0,00	98,29	0,13	0,42	0,01	1,48	1,37	0,00	0,15	0,09	2,99
20	0	27,443	3-Ferro	25-Stainless 18	1,70	0,27	0,11	2,08	0,23	0,00	27,44	0,17	1,54	0,00	0,21	4,07	0,00	0,22	2,37	63,88
21	0	57,182	4-Non-fer	26-Al sheet/ext	12,94	0,00	0,00	0,00	0,00	0,00	263,35	0,70	4,52	0,00	0,34	0,24	6,49	1,14	2,35	0,33
22	0	36	4-Non-fer	28-Cu winding	5,14	0,00	0,00	0,00	0,00	0,03	721,44	0,27	10,94	0,00	0,14	2,03	0,20	0,11	0,23	5,70
23	0	145,53	4-Non-fer	29-Cu wire	16,96	0,00	0,00	0,00	0,00	0,04	2912,32	0,90	42,51	0,00	0,54	8,01	0,78	0,41	13,69	22,49
24	0	43,971	4-Non-fer	30-Cu tube/she	2,24	0,00	0,00	0,00	0,00	0,00	352,38	0,12	2,75	0,00	0,45	1,45	0,24	0,06	1,66	2,72
25	0	0,7011	4-Non-fer	31-CuZn38 cas	0,03	0,00	0,00	0,00	0,00	0,00	2,13	0,00	0,02	0,00	0,02	0,04	0,00	0,00	0,01	0,01
26	0	0,835	5-Coating	40-CuNi/Cr pla	0,10	0,09	0,00	0,01	0,06	0,00	0,70	0,00	0,06	0,00	0,01	0,68	0,00	0,00	0,01	3,33
27	0	0,249	5-Coating	41-Au/Pt/Pd	56,10	50,43	0,00	0,00	0,00	6,49	45837,50	4,42	0,09	0,00	0,00	0,03	0,00	0,00	0,00	0,00
28	0	74,305	6-Electror	42-LCD per m2	264,76	168,67	0,00	3,34	49,76	0,07	3,86	13,70	4,40	0,03	0,02	0,06	0,01	0,04	0,02	0,00
29	0	90,494	6-Electror	44-big caps & c	34,68	0,00	0,00	3,14	4,98	1,77	54,34	1,95	12,83	0,01	0,20	0,69	18,52	3,22	5,72	0,65
30	0	28,178	6-Electror	45-slots / ext. p	5,27	1,67	0,00	2,10	7,20	0,48	8,67	0,28	5,19	0,00	0,04	1,07	0,05	0,37	0,90	182,30
31	0	2,6925	6-Electror	46-IC's avg., 5%	14,83	14,43	0,00	13,51	0,00	0,68	13,95	1,14	7,50	0,18	0,13	1,20	0,04	0,20	10,07	57,84
32	0	4,1933	6-Electror	47-IC's avg., 1%	3,67	2,82	0,01	2,56	0,43	2,70	7,33	0,25	3,42	0,00	0,04	0,78	0,01	0,10	0,04	18,02
33	0	13,797	6-Electror	48-SMD/ LED's	40,96	39,81	0,00	12,77	0,00	1,80	39,06	2,30	22,36	0,10	0,21	5,82	0,06	0,70	0,20	30,29
34	0	107,42	6-Electror	49-PWB 1.2 lay	30,19	16,17	0,92	18,26	8,25	186,18	282,01	1,21	22,96	0,25	0,29	3,88	0,38	0,55	1,58	395,99
35	0	29,299	6-Electror	50-PWB 6 lay 4.	10,76	4,28	0,25	14,21	2,25	55,43	119,34	0,45	11,60	0,03	0,15	2,05	0,20	1,09	3,68	71,57
36	0	7,1759	6-Electror	51-PWB 6 lay 2	3,50	2,39	0,08	2,89	0,74	30,54	16,75	0,15	1,57	0,00	0,02	0,24	0,02	0,05	2,34	20,42
37	0	5,0918	6-Electror	52-Solder SnAg	1,19	0,99	0,00	0,36	0,00	0,02	1,16	0,05	0,33	0,00	0,01	0,02	0,01	0,01	0,00	0,03
38	0	650,2	7-Misc.	54-Glass for la	10,55	8,41	0,00	5,54	0,00	0,17	8,80	0,54	1,95	0,00	0,05	0,11	0,00	0,04	0,03	0,23
39	0	901,84	7-Misc.	56-Cardboard	25,23	1,80	14,42	6,35	0,00	0,04	47,14	0,63	0,94	0,00	0,01	0,03	0,00	0,01	0,01	77,54
40	0	161,11	7-Misc.	57-Office paper	6,44	0,97	4,35	12,27	0,00	0,05	10,88	0,09	0,81	0,03	0,01	0,02	0,00	0,27	0,01	851,99
41	0	115,75	6-Electror	98-controller b	90,46	67,07	0,35	60,58	12,23	75,52	194,42	5,95	50,82	0,75	0,74	8,51	6,99	2,59	33,58	544,27
	DTA	0	0	0	1.162	416	253	205	958	385	55.417	57	320	2	54	49	277	28	107	4.710

Table A18. Environmental assessment from MEEuP method for the base case V6 (including paper)

Table . Life Cycle Impact (per unit) of Base Case V6_IJ-MFD-Workgroup (incl. Paper)

Nr	Life cycle impact per product:	Date	Author
0	Base Case V6_IJ-MFD-Workgroup (incl. Paper)	0	0

	Life Cycle phases -->		PRODUCTION			DISTRI-	USE	END-OF-LIFE*			TOTAL
	Resources Use and Emissions		Material	Manuf.	Total	BUTION		Disposal	Recycl.	Total	
	Materials	unit									
1	Bulk Plastics	g			4453			4008	445	4453	0
2	TecPlastics	g			489			440	49	489	0
3	Ferro	g			1929			193	1736	1929	0
4	Non-ferro	g			293			29	264	293	0
5	Coating	g			0			0	0	0	0
6	Electronics	g			478			336	142	478	0
7	Misc.	g			1712			171	1541	1712	0
	Total weight	g			9355			5177	4177	9355	0
	Other Resources & Waste							debet	see notel credit		
8	Total Energy (GER)	MJ	1162	275	1437	91	4058	376	275	101	5687
9	of which, electricity (in primary MJ)	MJ	416	144	560	0	1307	0	18	-18	1938
10	Water (process)	ltr	205	5	211	0	6003	0	16	-16	6198
11	Water (cooling)	ltr	958	76	1034	0	2473	0	14	-14	3493
12	Waste, non-haz./ landfill	g	55417	851	56269	70	6902	1148	55	1093	64335
13	Waste, hazardous/ incinerated	g	385	1	387	1	52	4590	20	4570	5010
	Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	57	16	73	7	85	28	19	9	173
15	Ozone Depletion, emissions	mg R-11 eq	negligible								
16	Acidification, emissions	g SO2 eq.	320	71	392	19	633	56	35	21	1065
17	Volatile Organic Compounds (VOC)	g	2	1	3	1	16	1	0	0	20
18	Persistent Organic Pollutants (POP)	ng i-Teq	54	6	59	0	10	8	0	8	77
19	Heavy Metals	mg Ni eq.	49	13	62	4	25	102	2	100	191
	PAHs	mg Ni eq.	277	1	278	4	6	0	2	-2	286
20	Particulate Matter (PM, dust)	g	28	13	42	99	135	487	1	486	762
	Emissions (Water)										
21	Heavy Metals	mg Hg/20	107	0	107	0	10	31	9	22	139
22	Eutrophication	g PO4	5	0	5	0	413	2	0	2	419
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible								

Table A19. Summary of environmental assessment from MEEuP method for the base case V1 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base_Case_V1_EP-Copier_MFD-mono (incl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	129	PJ
of which, electricity	3,2	TWh
Water (process)*	202	mln.m3
Waste, non-haz./ landfill*	297	kton
Waste, hazardous/ incinerated*	17	kton
Emissions (Air)		
Greenhouse Gases in GWP100	3	mt CO2eq.
Acidifying agents (AP)	20	kt SO2eq.
Volatile Org. Compounds (VOC)	1	kt
Persistent Org. Pollutants (POP)	1	g i-Teq.
Heavy Metals (HM)	2	ton Ni eq.
PAHs	1	ton Ni eq.
Particulate Matter (PM, dust)	0	kt
Emissions (Water)		
Heavy Metals (HM)	1	ton Hg/20
Eutrophication (EP)	14	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base_Case_V1_EP-Copier_MFD-mono (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	24	PJ
of which, electricity	1,7	TWh
Water (process)*	2	mln.m3
Waste, non-haz./ landfill*	120	kton
Waste, hazardous/ incinerated*	16	kton
Emissions (Air)		
Greenhouse Gases in GWP100	1	mt CO2eq.
Acidifying agents (AP)	7	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	1	g i-Teq.
Heavy Metals (HM)	1	ton Ni eq.
PAHs	1	ton Ni eq.
Particulate Matter (PM, dust)	3	kt
Emissions (Water)		
Heavy Metals (HM)	1	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

Table A20. Summary of environmental assessment from MEEuP method for the base case V2 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V2 - MFD - Copier Color (with paper)

main life cycle indicators	value	unit
Total Energy (GER)	10	PJ
of which, electricity	0,3	TWh
Water (process)*	13	mln.m3
Waste, non-haz./ landfill*	51	kton
Waste, hazardous/ incinerated*	5	kton
Emissions (Air)		
Greenhouse Gases in GWP100	0	mt CO2eq.
Acidifying agents (AP)	2	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	0	g i-Teq
Heavy Metals (HM)	0	ton Ni eq
PAHs	0	ton Ni eq.
Particulate Matter (PM, dust)	1	kt
Emissions (Water)		
Heavy Metals (HM)	0	ton Hg/20
Eutrophication (EP)	1	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V2 - MFD - Copier Color (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	4	PJ
of which, electricity	0,2	TWh
Water (process)*	0	mln.m3
Waste, non-haz./ landfill*	40	kton
Waste, hazardous/ incinerated*	5	kton
Emissions (Air)		
Greenhouse Gases in GWP100	0	mt CO2eq.
Acidifying agents (AP)	1	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	0	g i-Teq.
Heavy Metals (HM)	0	ton Ni eq.
PAHs	0	ton Ni eq.
Particulate Matter (PM, dust)	1	kt
Emissions (Water)		
Heavy Metals (HM)	0	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

Table A21. Summary of environmental assessment from MEEuP method for the base case V3 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case_V3_EP-Printer-SFD-mono (incl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	**447**	PJ
of which, electricity	9,9	TWh
Water (process)*	**752**	mln m3
Waste, non-haz./ landfill*	**827**	kton
Waste, hazardous/ incinerated*	**41**	kton
Emissions (Air)		
Greenhouse Gases in GWP100	**8**	mt CO2eq.
Acidifying agents (AP)	**64**	kt SO2eq.
Volatile Org. Compounds (VOC)	**2**	kt
Persistent Org. Pollutants (POP)	**2**	g I-Teq.
Heavy Metals (HM)	**4**	ton Ni eq.
PAHs	**1**	ton Ni eq.
Particulate Matter (PM, dust)	**22**	kt
Emissions (Water)		
Heavy Metals (HM)	2	ton Hg/20
Eutrophication (EP)	52	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case_V3_EP-Printer-SFD-mono (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	**55**	PJ
of which, electricity	4,3	TWh
Water (process)*	**5**	mln m3
Waste, non-haz./ landfill*	**165**	kton
Waste, hazardous/ incinerated*	**38**	kton
Emissions (Air)		
Greenhouse Gases in GWP100	**3**	mt CO2eq.
Acidifying agents (AP)	**15**	kt SO2eq.
Volatile Org. Compounds (VOC)	**0**	kt
Persistent Org. Pollutants (POP)	**1**	g I-Teq.
Heavy Metals (HM)	**3**	ton Ni eq.
PAHs	**1**	ton Ni eq.
Particulate Matter (PM, dust)	**6**	kt
Emissions (Water)		
Heavy Metals (HM)	2	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

Table A22. Summary of environmental assessment from MEEuP method for the base case V4 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case_V4_EP-Printer-SFD-color (incl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	**63**	PJ
of which, electricity	1,5	TWh
Water (process)*	**99**	mln m3
Waste, non-haz./ landfill*	**147**	kton
Waste, hazardous/ incinerated*	**14**	kton
Emissions (Air)		
Greenhouse Gases in GWP100	**1**	mt CO2eq.
Acidifying agents (AP)	**10**	kt SO2eq.
Volatile Org. Compounds (VOC)	**0**	kt
Persistent Org. Pollutants (POP)	**1**	g I-Teq.
Heavy Metals (HM)	**1**	ton Ni eq.
PAHs	**1**	ton Ni eq.
Particulate Matter (PM, dust)	**4**	kt
Emissions (Water)		
Heavy Metals (HM)	1	ton Hg/20
Eutrophication (EP)	7	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case_V4_EP-Printer-SFD-color (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	**12**	PJ
of which, electricity	0,8	TWh
Water (process)*	**1**	mln m3
Waste, non-haz./ landfill*	**60**	kton
Waste, hazardous/ incinerated*	**13**	kton
Emissions (Air)		
Greenhouse Gases in GWP100	**1**	mt CO2eq.
Acidifying agents (AP)	**3**	kt SO2eq.
Volatile Org. Compounds (VOC)	**0**	kt
Persistent Org. Pollutants (POP)	**0**	g I-Teq.
Heavy Metals (HM)	**1**	ton Ni eq.
PAHs	**1**	ton Ni eq.
Particulate Matter (PM, dust)	**2**	kt
Emissions (Water)		
Heavy Metals (HM)	0	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

Table A23. Summary of environmental assessment from MEEuP method for the base case V5 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V5_IJ-MFD-Personal (incl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	47	PJ
of which, electricity	2,1	TWh
Water (process)*	30	mln.m3
Waste, non-haz./ landfill*	750	kton
Waste, hazardous/ incinerated*	62	kton
Emissions (Air)		
Greenhouse Gases in GWP100	2	mt CO2eq.
Acidifying agents (AP)	10	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	1	g I-Teq.
Heavy Metals (HM)	2	ton Ni eq.
PAHs	4	ton Ni eq.
Particulate Matter (PM, dust)	8	kt
Emissions (Water)		
Heavy Metals (HM)	2	ton Hg/20
Eutrophication (EP)	2	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V5_IJ-MFD-color (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	33	PJ
of which, electricity	1,9	TWh
Water (process)*	3	mln.m3
Waste, non-haz./ landfill*	726	kton
Waste, hazardous/ incinerated*	62	kton
Emissions (Air)		
Greenhouse Gases in GWP100	2	mt CO2eq.
Acidifying agents (AP)	9	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	1	g I-Teq.
Heavy Metals (HM)	2	ton Ni eq.
PAHs	4	ton Ni eq.
Particulate Matter (PM, dust)	7	kt
Emissions (Water)		
Heavy Metals (HM)	2	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

Table A24. Summary of environmental assessment from MEEuP method for the base case V5 when paper is included and excluded

Incl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V6_IJ-MFD-Workgroup (incl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	39	PJ
of which, electricity	1,2	TWh
Water (process)*	35	mln.m3
Waste, non-haz./ landfill*	618	kton
Waste, hazardous/ incinerated*	50	kton
Emissions (Air)		
Greenhouse Gases in GWP100	1	mt CO2eq.
Acidifying agents (AP)	8	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	1	g I-Teq.
Heavy Metals (HM)	2	ton Ni eq.
PAHs	3	ton Ni eq.
Particulate Matter (PM, dust)	7	kt
Emissions (Water)		
Heavy Metals (HM)	1	ton Hg/20
Eutrophication (EP)	2	kt PO4

*=caution: low accuracy for production phase

Excl. Paper

Table . Summary Environmental Impacts EU-Stock 2005, Base Case V6_IJ-MFD-workgroup (excl. Paper)

main life cycle indicators	value	unit
Total Energy (GER)	21	PJ
of which, electricity	1,0	TWh
Water (process)*	2	mln.m3
Waste, non-haz./ landfill*	584	kton
Waste, hazardous/ incinerated*	50	kton
Emissions (Air)		
Greenhouse Gases in GWP100	1	mt CO2eq.
Acidifying agents (AP)	6	kt SO2eq.
Volatile Org. Compounds (VOC)	0	kt
Persistent Org. Pollutants (POP)	1	g I-Teq.
Heavy Metals (HM)	2	ton Ni eq.
PAHs	3	ton Ni eq.
Particulate Matter (PM, dust)	6	kt
Emissions (Water)		
Heavy Metals (HM)	1	ton Hg/20
Eutrophication (EP)	0	kt PO4

*=caution: low accuracy for production phase

ANNEX 2

Blue Angel Ecolabel criteria on imaging equipment excerpt. Administrative criteria were left out.

3 Requirements and Compliance Verifications

3.1 General Requirements

3.1.1 Recyclable Design

Office equipment bearing the Blue Angel must be easily recyclable. The Checklist „Recyclable Design of Equipment" (Annex 1 to the Basic Award Criteria) identifies characteristics that are prerequisites for good recyclability.
These characteristics include among others:

Structure and Joining Technique

- Avoidance of non-separable connections (e.g. glued, welded) between different materials, unless they are technically required;
- easily separable mechanical connections;
- easy detachability of equipment by only one person;

Material Selection

- To reduce the multitude of materials, plastic casing parts that weigh more than 25 grams must consist of a single polymer or polymer blend. Plastic casings may consist of up to four separable polymers or polymer blends at the most.
- Large-size casing parts must be so designed as to ensure that the plastics used can be recycled on the basis of existing recycling technologies for the manufacture of high-quality long-life products. Such casing parts may not have a metallic coating.
- The coating of special parts should be kept to a minimum and reasons for coating shall be given.
- Galvanic coatings of plastic parts shall, however, not be permitted.
- The use of recyclate plastics that meet the material requirements under para. 3.1.2 is permissible and desirable.
- Reusable parts that meet all relevant requirements shall be used with preference.

Recycling of Equipment after Use

- Components and materials according to Annex III to the Electrical and Electronic Equipment Act (ElektroG), must be easily identifiable and removable (e.g. toner

modules, mercury-containing lamps for the lightning of liquid crystal displays as well as the liquid crystal displays themselves).

- The applicant shall provide information on the disassembly of equipment at recycling or treatment plants with regard to the individual components and materials.
- The applicant shall inform RAL about envisaged ways and methods of recycling of components and disposal (recycling and disposal) of devices according to the Electrical and Electronic Equipment Act (ElektroG).

Compliance Verification:

The applicant shall complete the Checklist „Recyclable Design" (Annex 1 to the Basic Award Criteria). The requirements shall be met if all Category M questions have been answered "Yes".

The applicant shall name the casing plastics used for parts > 25 grams and submit a list of plastics (according to Appendix 4) attached to the application according to RAL-UZ 122). This shall include information on the range of recyclate in plastics as permitted by the applicant.

The applicant shall indicate the envisaged measures for reuse and recycling of equipment in Appendix 11 to the Application.

The applicant shall declare in Appendix 1 to the Application that the contracted recycling company will be provided with information as required for an effective disassembly, modules as well as on the substances and components requiring selective treatment.

3.1.2 Material Requirements

3.1.2.1 Material Requirements for Plastics of Casings, Casing Parts

Halogenated polymers and additions of organic halogenated compounds as flame retardants shall not be permissible.

Exempted from this rule are:

- Fluoroorganic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent.
- Fluoroplastics as, for example, PTFE.

- Plastic parts weighing less than 25 grams. However, they may not contain PBBs (polybrominated biphenyls), PBDEs (polybrominated diphenyl ethers) or chlorinated paraffins. (This exemption does not apply to keyboard keys.)
- Special plastic parts located close to heating and fuser elements. They may not, however, contain PBBs, PBDEs or chlorinated paraffins.
- Large-sized plastic parts which are reused as can be proved and which are marked according to para. 3.1.3. They may not, however, contain PBBs, PBDEs or chlorinated paraffins.

Flame retardants used in plastic parts with a mass greater than 25 grams shall be named to RAL and identified by their CAS Number.

Other substance bans according to Section 5, Electrical and Electronic Equipment Act (ElektroG) shall be respected.

In addition, no substances may be added to the plastics which are classified according to Directive 67/548/EEC as

- carcinogenic according to Category Carc.Cat.1, Carc.Cat.2 or Carc.Cat.3,
- mutagenic according to Category Mut.Cat.1, Mut.Cat.2 or Mut.Cat.3;
- reprotoxic according to Category Repr.Cat.1, Repr.Cat.2, Repr. Cat.3

or which are classified in TRGS 905 accordingly.

Both regulations have been considered in the overall list of all substances classified as carcinogenic, mutagenic or reprotoxic[5].

Exempted are process-related technologically unavoidable impurities.

Compliance Verification:

The applicant shall declare compliance with the requirements in Appendix 1 to the Application. With regard to flame retardants the applicant shall prompt the plastic suppliers to send a written statement to RAL stating that the banned substances have not been added to the casing plastics (Appendix 5). This also applies to the recyclate plastics used. At the same time, the applicant undertakes to prompt the casing plastics suppliers to confidentially report the chemical designation of the flame retardants used (CAS-Nr.) to RAL (Appendix 5 as well).

[5] www.baua.de

3.1.2.2 Material Requirements for the Plastics used in Printed Circuit Boards

The base material of printed circuit boards may not contain PBBs (polybrominated biphenyls), PBDEs (polybrominated diphenyl ethers) or chlorinated paraffins.

Compliance Verification:

The applicant shall declare compliance with the requirement in Appendix 1 to the Application or submit declarations from the suppliers of printed circuit boards stating that the banned substances are not contained in the boards.

3.1.3 Marking of Plastics

Plastic parts with a weight greater than 25 grams and a plane surface of at least 200 square millimeters, must be permanently marked according to ISO 11469:2000, taking ISO 1043, Parts 1 - 4, into consideration.
Exempted are plastic parts contained in reused complex modules.

Compliance Verification:

The applicant shall declare compliance with the requirement in Appendix 1 to the Application and indicate the marking in the list of plastics according to para. 3.1.1 in Appendix 4.

3.1.4 Batteries

Batteries and accumulators may not contain the heavy metals lead, cadmium or mercury. Exempted are technically unavoidable impurities. They may not exceed the limits given in Directive 91/157/EEC on Batteries and Accumulators, as amended (adapted to technical progress by Directive 98/101/EC)[6].
The applicant undertakes to accept the free return of the original user-exchangeable batteries/accumulators. A third party may be subcontracted for this task.
Under the Batterieverordnung [Battery Ordinance], as amended, the product documents need to include the necessary relevant information as well as details regarding take-back options and user's obligation to dispose of batteries and accumulators at a return facility and under no circumstances via the household waste system.

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[6] The EU Battery Directive is currently being revised. The revised version must be complied with from the time of its coming into force.

Batteries and accumulators which are not designed for exchange by the user must be replaceable at the end of their useful life without needing to exchange the entire printed circuit board or similar parts holding such batteries or accumulators.

Compliance Verification:

The applicant shall declare compliance with the requirements in Appendix 1 to the Application and, if the occasion arises, submit a declaration from the battery manufacturer. In addition, the applicant shall name the types of batteries/accumulators in the user documents (Appendix 12) and inform about the take-back system.

3.1.5 Printing Paper

The devices must be capable of processing recycled paper made of 100 % post consumer paper that meets the requirements of EN 12281:2002. The applicant shall be free to recommend certain types of recycled paper.

The user information shall include the following note: „This device is suited for processing recycled paper." A reference to EN 12281:2002 may be included.

Compliance Verification:

The applicant shall submit the corresponding user information (Appendix 12; see also paragraph 4)

3.1.6 Double-Sided Printing and Copying

Devices with a maximum operating speed of ≥ 45 A4 sized pages (or comparable format) per minute must, as a matter of principle, be equipped with a unit for automatic double-sided printing/copying (so-called duplex unit).

All other devices with a lower maximum operating speed must at least offer a manual option (copiers) or an extra software-based option (printers, multifunction devices) for double-sided printing on A4 size paper.

Electrophotographic devices with a maximum operating speed of 21 to 44 pages per minute must additionally be capable of being equipped - at least optionally - with a duplex unit.

The user documents to be provided by applicant shall include information on options for double-sided printing, the existence of a duplex unit or its availability as an upgrade.

Compliance Verification:

The applicant shall declare compliance with the requirement in Appendix 1 to the Application and submit the relevant user information (Appendix 12; see also paragraph 4).

3.1.7 Potoconductor Drums

Photoconductor drums may not contain selenium, lead, mercury or cadmium or any of their compounds as constituents.

Spent photoconductor drums shall be taken back by applicant (free of charge at a return facility) and either be recovered for reuse or subjected to material recycling.

The user information shall include details regarding take-back and return facility. Such facility shall be in located Germany or, respectively, in the country where the product is offered with reference to the Blue Angel.

Compliance Verification:

The applicant shall declare In Appendix 1 to the Application that the aforementioned substances are not contained in the photoconductor drums and that exchanged drums will be taken back and recycled. The applicant shall indicate the recycling method (Appendix 11 or 12) and refer to the take-back option in the user documents (Appendix 12; see also paragraph 4).

Material Safety Data Sheets shall be submitted to RAL upon request.

3.1.8 Guarantee of Repairs

The applicant undertakes to see to it that spare parts supply and necessary infrastructure for equipment repair is secured for a period of at least 5 years after the end of production and that users are informed about the guaranteed availability of spare parts.

Spare parts - or parts to be replaced - are those parts which typically have the potential to fail during the normal use of the product. In contrast, those parts whose life cycle usually exceeds the usual life of the product need not be provisioned as spare parts.

Compliance Verification:

The manufacturer shall demonstrate compliance with the requirement by presenting the user documents (Appendix 12; see also paragraph 4).

3.1.9 Maintenance of Equipment

Maintenance has great influence on the environmental features of a device. That is why maintenance should only be performed by qualified service persons. The user documents shall include instructions for equipment cleaning and maintenance, provided that such measures are necessary. Users shall be informed about a possibly required replacement of the ozone or dust filter.

Compliance Verification:

The manufacturer shall inform in the user documents about type and extent of maintenance work needed and its performance by qualified persons (Appendix 12; see also paragraph 4).

3.1.10 Product Take-Back

The applicant undertakes to take back own manufactured products bearing the Blue Angel eco-label after use in order to channel them with preference to reuse or to material recycling in terms of the Electrical and Electronic Equipment Act (ElektroG). Non-recyclable device parts shall be disposed of in an environmentally sound manner. Waste equipment from private households[7] may always be given to municipal collection facilities free of charge. Waste equipment from the business sector shall be returned to the applicant or to a return facility to be named by applicant. This presupposes that such Blue Angel labelled devices are returned in a condition consistent with its intended use.

The return facilities named by applicant must be located in Germany or in the country where the product is offered with reference to the Blue Angel. It must be possible to return the device either personally or by shipping services. The product documents shall include details on the equipment return options.

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[7] According to the Electrical and Electronic Equipment Act (ElektroG), equipment from small-scale businesses shall be treated in the same way because it may be passed over to the private final consumer.

Compliance Verification:

The applicant shall declare compliance with the requirement in Appendix 1 to the Application and demonstrate compliance by submitting the user information (Appendix 12; see also paragraph 4).

3.1.11 Packaging

Plastics used for product packaging may not contain halogen-containing polymers. The plastics used must be marked in accordance with the German Verpackungsordnung (Packaging Ordinance), as amended.

Compliance Verification:

The applicant shall declare compliance with the requirement and include information on the marking of packaging plastics used in Appendix 1 to the Application.

3.2 Requirements for Toners and Inks as well as for Modules and Containers for Toner and Ink

3.2.1 Modules and Containers for Toner and Ink

3.2.1.1 Recyclable Design and Reuse

Toner modules and containers as well as ink modules and containers supplied by the applicant along with the original equipment, as well as those recommended in the product documents for use in the respective device, must be so designed as to ensure their channeling to reuse or material recycling. They shall meet the relevant requirements as specified the Checklist "Recyclable Design" (Annex 1 to the Basic Award Criteria). Reuse shall always be given preference over recycling. That is why no parts designed to prevent the reuse of toner or ink modules may be attached to the modules.

If devices are originally equipped with toner or ink modules whose toner or ink content is atypically low users have to be explicitly informed about it.

Compliance Verification:

The applicant shall declare compliance with the requirement by completing the relevant sections of the Check List „Recyclable Design" (Annex 1 to the Basic Award Criteria) and answers „YES" to all the "M" requirements.

The applicant shall inform RAL by Annex 11 to the Contract about projected reuse or recovery methods.

If applicable, the applicant shall additionally give details in the user information on an atypically low capacity of toner or ink modules supplied along with the equipment (Appendix 12; see also paragraph 4).

3.2.1.2 Take-Back

The applicant undertakes to accept the return of toner/ink modules and toner/ink containers supplied or recommended by applicant for use in the product documents in order to channel such modules and container to reuse or material recycling with preference given to reuse. This also applies to residual toner containers. A third party (dealers and service agencies or companies engaged in the module recycling business) may be subcontracted to perform this task. The formers shall be provided with instructions for proper handling of residual toner.

Non-recyclable product parts shall be properly disposed of.

Modules and containers shall be taken back free of charge by the return facility named by the applicant to which products may be returned personally or by shipment. (Return facilities abroad shall only be permissible if the products can be sent there free of charge.) The product documents shall include detailed information on the return system.

Compliance Verification:

The applicant shall demonstrate compliance with the requirement in the user information (Appendix 12; see also paragraph 4).

The applicant shall declare compliance in Appendix 1 to the Application and document the instructions for the recycling contractor for dealing with residual toner (e.g. by means of the EC Material Safety Data Sheet) and by means of the note: „Prevent toner dust from being released into the air") (Appendix 6b).

3.2.1.3 Specific Instructions for Handling Toner Modules

Toner modules and containers must be sealed so as to prevent toner dust from escaping during storage and transport. The user information shall include explicit instructions for proper handling of toner modules. In addition, the user information shall include a note warning the user that toner modules may not be forced open and that in case toner dust has escaped as a result of improper handling inhaling the dust and skin contact should be avoided as precaution. The user information shall additionally include instructions on what to do in case of skin contact.

In addition, it needs to be stressed that toner modules must be kept away from children.

Compliance Verification:

The applicant shall submit the user information (Appendix 12; see also para. 4).

3.2.2 Material-Related Requirements for Toners for Use in Electrophotographic Devices and Inks for Use in Ink jet Devices

3.2.2.1 Hazardous Substances

Toners and inks may not contain substances as constituents which are classified according to Gefahrstoffverordnung (Ordinance on Hazardous Substances)[8] pursuant to Annex I to Directive 67/548/EEC (Publication of the List of Hazardous Substances and Preparations including all adaptation directives) and which require labelling according to Annex VI of said directive with the following R Phrases[9]:

R 40 (Limited evidence of a carcinogenic effect)

R 45 (May cause cancer)

R 46 (May cause heritable genetic damage)

R 49 (May cause cancer by inhalation)

R 60 (May impair fertility)

R 61 (May cause harm to the unborn child)

R 62 (Possible risk of impaired fertility)

R 63 (Possible risk of harm to the unborn child)

R 68 (Possible risk of irreversible effects)

or are classified as carcinogenic, mutagenic or reprotoxic substances according to TRGS 905[10] (as amended). (Both regulations have been taken into consideration in the overall list of substances classified as carcinogenic, mutagenic or reprotoxic,

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[8] GefStoffV (Ordinance on Hazardous Substances) of 23 December 2004, BGBl (Federal Law Gazette) I, page 3758; see also http://www.baua.de

[9] *Explanation:*
The EU System for CMR properties uses the following markings:

R 45, R 49	*carcinogenic Category 1-2*
R 40	*carcinogenic Category 3*
R 46	*mutagenic Category 1-2*
R 68	*mutagenic Category 3*
R 60, R 61	*reprotoxic Category 1-2*
R 62, R 63	*reprotoxic Category 3*

so-called CMR substances[11]),
or which according to Section 5, Ordinance on Hazardous Substances, must be classified according to Annex VI to Directive 67/548/EEC by manufacturers or importers themselves.

Substances that require labelling of the entire product with the R43 Phrase (May cause sensitization by skin contact) may not be included either.
It is assumed that substances that would require labelling as „toxic" or „very toxic" will not be used as a matter of principle.

Compliance Verification:
The applicant shall demonstrate compliance with requirements by submitting a test report or a declaration signed by an authorized representative of the company (Appendix 6a). Material Safety Data Sheets for all toners and inks shall be submitted upon filing of the application (Appendix 6b). Provided that the Material Safety Data Sheets do not show a negative AMES Test the test result of such test shall be given separately (Appendix 6c).

3.2.2.2 Heavy Metals

No substances may be added to toners and inks which contain mercury, cadmium, lead, nickel or chromium-VI-compounds as constituents. Exempted are high molecular weight complex nickel compounds as colorants.
Production-related contamination by heavy metals, such as cobalt and nickel oxides shall be kept as low as technically possible and economically reasonable (ALRA principle - as low as reasonably achievable).

Compliance Verification:
The applicant shall demonstrate compliance with the requirement by submission of the a declaration from the ink or toner manufacturer (Appendix 6a).

3.2.2.3 Azo Dyes

Azo dyes (dyestuffs or pigments) that might release carcinogenic aromatic amines appearing on the list of aromatic amines in Directive 2002/61/EC (see also TRGS 614) may not be used in toners and inks.

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[10] http://www.baua.de/

Compliance Verification:

The applicant shall demonstrate compliance with the requirement by presenting a declaration from the ink or toner manufacturer (Appendix 6a).

3.2.2.4 Biocides in Inks

Only those substances may be added as active biocides to inks which are listed as so-called existing substances in Annex II to Commission Regulation EC 2032/2003 amended by Regulation EC 1048/2005[12]. The use of new (non-listed) active substances would require approval according to the Biozidgesetz (Biocidal Products Act)[13].

Compliance Verification:

The applicant shall demonstrate compliance with the requirement by submitting a declaration from the ink manufacturer (Appendix 6a).

3.3 Substance Emissions

3.3.1 Comment

Also, electronic devices emit volatile organic substances into the indoor air, with the amount of these substances being time-dependent. Heating and printing processes intensify the release (emission) of such substances. Depending on the technology used ozone can additionally be generated during the operation of printing devices. Additionally, there are dust emissions which mainly consist of paper and toner dust (in electrophotographic devices). These emissions should be kept as low as possible in order to maintain good indoor air quality. This is supported by both the limita-

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[11] www.baua.de/prax/ags/cmr_liste.htm

[12] Commission Regulation (EC) No. 2032/2003 of 4 November 2003 on the second phase of the 10-year work programme referred to in Article 16, (2) of Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market and on the amendment of Regulation (EC) No. 1896/2000, Official Journal of the European Union L 307/1 of 24 November 2003, amended by the Commission Regulation (EC) No. 1048/2005 of 13 June 2005, Official Journal of the European Union L 178/1 of 9 July 2005.

[13] The Biocidal Products Directive 98/8/EC governs the marketing of biocidal active substances and biocidal products. As from the 1st of September 2006 only the existing biocidal agents may be used which appear on the "final list of existing biocidal active substances" in Annex II to Commission Regulation (EC) No. 2032/2003 amended by Commission Regulation (EC) 1048/2005 The 10-year review programme is expected to run until 13 May 2010. Thereafter, the respective biocidal products will require approval according to the German Biocidal Products Act.

tion of emissions within the scope of the requirements for the Blue Angel eco-label and an appropriate user behaviour.

Emission rates determined under defined conditions are used to characterize emissions.

In doing so, the volatile organic compounds are determined as summary parameters TVOC (total volatile organic compounds). In addition, benzene and styrene are determined as single substances. The same applies to ozone and dust.

Determination of emission rates according to Annex 2 to the Basic Award Criteria is done in ready mode[14] of the equipment as well as during continuous printing. Determination of the maximum permissible emission rates starts out from a use factor of monochrome printing equipment in print mode of 0.1, i.e. printing is actually done during 10% of the time theoretically available for uninterrupted printing. (This corresponds to a print volume of about 1000 pages per working day for a device that prints about17 pages/minute.)

A use factor of 0.05, i.e. half of the above value, is assumed, for the time being, for colour printing equipment.

The use factor for the ready phase is 1. The equipment-related emission of newly produced devices will, however, decrease with the passing of time. It is lower for desktop products – primarily because of the lower material and component volume.

The maximum permissible emission rates for ready and print phase in Table 1 consider, from a precautionary perspective, the influence of ready and printing phase on indoor air quality on a proportionate basis.

3.3.2 Electrophotographic Devices

Electrophotographic devices are tested for emissions of volatile organic substances in a ready phase prior to print start. During the printing process they are tested for release of TVOC, styrene and benzene as well as for that of dust and ozone. The emission rates in ready and in printing phase shall be determined and recorded according to the test method described in Annex 2 to the RAL-UZ 122 Basic Award Criteria. They may not exceed the values shown in Table 1:

[14] This ready phase comprises the pre-set time profile of equipment power consumption for one hour.

Table 1

Permissible Maximum Emission Rates Determined According to Annex 2

Substance	Emission rate Print phase (mg/h)		Emission rate Ready phase (mg/h).	
	Colour Printing Total in ready + print phase	Monochrome printing Total in ready + print phase	Desktop products	Floor-mounted equipment (Volume >250 litres)
TVOC	**18**	10	1	2
Benzene	< 0.05	< 0.05		
Styrene	1.8	1.0		
Ozone	3.0	1.5		
Dust	4.0	4.0		

Provided that the emission rate determined also meets the limit values for monochrome printing when printing the colour test page no additional testing of colour equipment will be required for monochrome printing.

The test report shall list the types of toner used in the product for testing. Any change of type of toner shall be notified to RAL and will require a resubmission of a test report for the print phase.

The test report shall always contain month and year of product manufacture[15].

Compliance Verification:

The applicant shall submit a form completed by the testing laboratory (Appendix 7a) confirming compliance with the requirements of the Basic Award Criteria regarding the substance emissions for monochrome printing on monochrome devices as well as for colour printing and, if the occasion arises, for monochrome printing on colour equipment.

[15] The gap between testing and filing of the application should be less than 10 months.

A copy of the complete test report according to the test guideline (Annex 2) shall be enclosed (Appendix 7b).

3.3.3 Ink Jet Devices

TVOC shall be determined for ink jet devices on the basis of the work instructions in Annex 2 when printing the colour test page. Testing shall be performed at the print speed referred to by the manufacturer as normal or standard mode and which is normally factory preset.

When printing the colour test page a TVOC emission rate of 18 mg/hour may not be exceeded.

Provided that the emission rate determined also meets the limit values for monochrome printing when printing the colour test page no additional testing of colour equipment will be required for monochrome printing.

The test report shall list the type of ink used for testing. Any change of the type of ink shall be notified to RAL and will require a resubmission of a test report for the print phase.

Compliance Verification:

The applicant shall submit a form completed by the testing laboratory (Appendix 7a) confirming compliance with the requirements of the RAL-UZ 122 Basic Award Criteria regarding the substance emissions. A copy of the complete test report according to the test guideline (Annex 2) must be enclosed as well (Appendix 7b).

The qualification of the testing laboratory for the emission measurements under paras. 3.3.2 and 3.3.3 shall, for the time being, be established to the satisfaction of Bundesanstalt für Materialforschung und –prüfung (Federal Institute for Materials Research and Testing) Working Group IV.2 „Emission from Materials" and documented in an Annex to the Test Report.

3.3.4 User Information on Substance Emissions

The user information shall include a statement confirming that the requirements for award of the Blue Angel eco-label have been checked and met with the consumables (type of toner or ink) supplied and recommended by the manufacturer.

The applicant shall further state that new electronic devices generally emit volatile substances into the indoor air and that, therefore, the user should ensure more fre-

quent air exchange in rooms where new equipment is set up or directly at the workplace, especially during the first days of use.

Compliance Verification:

The applicant shall submit the user documents (Appendix 12; see also para. 4).

3.3.5 Products of Identical Design

If two devices of identical design differ in their maximum print speed the product printing at higher speed shall be tested.

The result is considered as transferable to those products of identical design whose print speed falls short of the maximum print speed by not more than 20 percent.

When filing application for three or more devices of identical design printing at different speeds the product printing at highest speed and another one featuring a lower print speed shall be tested.

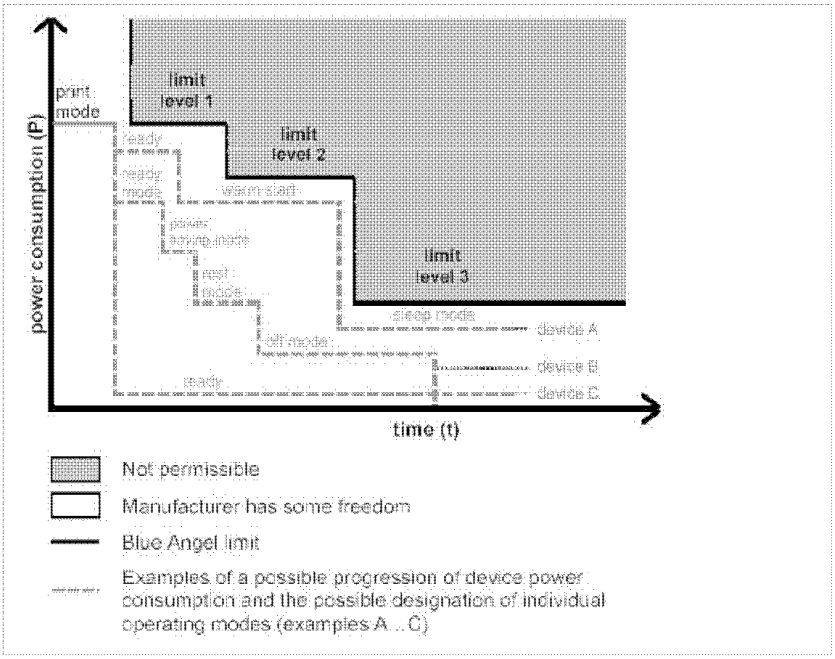
Further comments on devices of identical design can be found in Annex 4 to the Basic Award Criteria.

3.4 Energy

Note: An arrow (↑) preceding a term indicates that this term is defined in paragraph 2 or 3.4.1.

The Blue Angel sets a limit for the power consumption of the device for the time after ↑ the end of the printing process – be it for ↑ printing or for ↑ copying as well as for the time after the end of other ↑ primary functions. The size of this limit decreases in so-called limit levels with the time that elapses after the end of the printing process. The power consumption of the equipment shall not exceed this limit. For compliance with this requirement it is not decisive that the device has certain ↑ sleep modes, i.e. any kind of stand-by or ↑ energy-saving modes. What is decisive is the fact that the equipment does not exceed the limit curve. That means it is up to the manufacturer to lower the size of power consumption in one or more steps, as shown in **Fig. 1** by means of three examples.

Fig. 1: Blue Angel Limit Curve for Equipment Power Consumption during the Time that elapses after the end of the Printing Process



As **Fig. 1** shows, one limit curve is not necessarily assigned to one single sleep mode. One limit curve can also limit the power consumption of several sleep modes.

Example: In Fig. 1, the limit curve 1 of device B (middle line) refers to the modes „ready", „power-saving" and „sleep".

Likewise, various limit values can apply to a single sleep mode.

Example: In Fig. 1, the „warm start" mode of device A (upper line) may exceed neither limit level 1 nor limit level 2.

That is why paragraph 3.4.4 (power consumption) and para. 3.4.5 (times) give values which only describe the shape of the Blue Angel limit curve. They do not indicate limit values for individual sleep modes. A comparison between the shape of the power consumption curve of the device in this mode with the shape of the Blue

Angel limit curve give the limits set by the Blue Angel for a single operating mode of a single device.
After end of the printing process the devices usually switch into ↑ ready mode from which they can immediately start to print, if required.

Example: In Fig. 1 these are the modes „ready" and „low-power mode".

Afterwards, they usually go to a reduced power-consumption mode, a so-called ↑ energy-saving mode. Example in **Fig. 1**: the modes „warm start", „energy-saving mode" and so own. The power consumption in such energy-saving modes can be measured at a laboratory (unit: watts). To what extent these modes will contribute to a reduction in energy consumption in everyday office life (unit: kilowatt-hours) depends on whether they actually occur and, if so, for how long (unit: hours; hence: watts × hours = kilowatt-hours). On many devices the user can change the ↑ activation times of the energy-saving modes – that means they also can chose a very high value – or even deactivate the modes. If, however, a device needs a long ↑ return time, i.e. a time to return to ready mode so long that the user might regard it as burdensome and might try to chose as high a value as possible for the activation time of the energy-saving mode to prevent this mode from occurring very quickly and, thus, so very frequently. Or the user will even deactivate this mode. As a result, the device will remain in a higher power-consumption mode. To avoid this, it is necessary to make the user accept energy-saving modes and their consequences in everyday office life. That is why the Blue Angel sets a low limit for the return time (see para. 3.4.3). Apart from this, the user information shall include corresponding comments.
Measurements of power consumption and those of activation and return times shall be conducted in accordance with Annex 6 taking the comments in Annex 5 into account.

3.4.1 Definitions

To the extent possible, the following definitions are based on the definitions of Energy Star 10'2005[16]. In some cases, however, Energy Star does not offer an adequate definition so that either existing definitions had to be adapted or additional ones had to be created.

Blue Angel Limit Curve

3.4.1.1 Limit level (G_1, G_2 and G_3): section of the limit curve determined by the amount of power consumption P_i[17]. This section starts when after the last print the time t_{iA} has elapsed and ends when the next limit level begins, i.e. at the time $t_{(i+1)A}$. A limit level can also end when the user switches the device to the ↑ Plug-in Off mode or when the device goes to the ↑ standard operation mode.

Device Versions and Components

3.4.1.2 Base Unit: See definition in paragraph 2.

3.4.1.3 Upgrade: Term stands for all changes that lead to an increase in the number of ↑ primary functions of the ↑ base unit performed by device.

This primarily includes changes in the device technology and its control; be it by changing the existing technology/control or by installing new technology/control; be it inside or outside the device. Examples: exchange of existing components of the device; connection of a controller to the device; enabling certain functions by installing certain components (including chips) or installation of appropriate control software.

3.4.1.4 Upgrade level: level of equipment of a ↑ base unit with the extensions described under ↑ upgrade.

3.4.1.5 Accessory (according to the definition of Energy Star 10'2005 for „accessory"[16]): An optional piece of peripheral equipment that is not necessary for the operation of the ↑ base unit, but that may be added before or after shipment in order to add new functionality. An accessory may be sold separately under its own model number, or sold with a base unit as part of a multifunction device package or configuration.

Supplement: Controllers are not considered as accessories.

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[16] „Energy Star Qualified Imaging Equipment – Revised Terminology and Definitions", 28 October 2005

Note: a) Examples of accessories include sorters, high-capacity paper feeders, paper-finishing equipments, large paper supply devices, output paper organizers as well as chips and counters. b) The power consumption of accessories is not included in the power consumption of the device with which the device must meet the limit curve.

3.4.1.6 Delivery status: The condition in which the manufacturer ships the device and in which the manufacturer has set the ↑ activating times of individual operating modes.

3.4.1.7 Printing Unit: Unit of the device used to print on paper and similar data carriers – be it in the primary function ↑ copying, ↑ printing or printing of faxes.

3.4.1.8 Scanning Unit: Unit of the device used to optically scan paper documents or similar data carriers in order to convert them into electronic information that can be stored, edited, converted or transferred – primarily with the aim of using them for data processing in a device (copier) or in a computer. (mainly corresponds to the Energy Star 10'2005 definition of the function of „scanners" [16]).

3.4.1.9 Telephone modem: Unit of the device used to convert data received or sent via telephone line.

3.4.1.10 LAN[18] interface: Unit of the device used to transmit data between the device and a data network (LAN).

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[17] Here and hereinafter the letter „i" stands for index.

[18] LAN = local area network

Operating Modes

Survey of the Operating Modes:

Standard Operation Mode:	Sleep Modes:		
Print mode, Copy mode etc.	Ready Mode	Energy-saving Mode(s)	Plug-in Off

3.4.1.11 Standard Operation Mode (corresponding to the Energy Star 10'2005 definition of „active" mode[16]): In standard operation mode the product is connected to the mains and actively performs a ↑ primary function.

Note: An example of standard operation mode is the ↑ print mode.

3.4.1.12 Print Mode: In print mode the device puts out data by printing on paper and similar materials – be it in the primary function ↑ copying, ↑ printing or when faxing.

3.4.1.13 End of the printing process: point in time when during a print job the last printed page (or similar material) of the print job has left the ↑ print unit of the device so that it is available to the user. This is the case, for example, when the sheet of paper has reached the output tray. If there are different points in time possible for a device – for example, if the device has multiple output trays – the earliest of these points in time shall be considered as the end of the printing process in terms of these Basic Award Criteria.

3.4.1.14 Sleep Mode (Z_a, Z_b, etc.): The power state that the product enters after the ↑ end of the printing process - directly or upon expiry of an ↑ activation time (t_{aA}, t_{bA}, …). The sleep modes also include the ↑ Plug-in Off mode which is either user-activated by a switch or self-initiated by the device. In a sleep mode, the ↑ power consumption (P_a, P_b, …P_S) of the device is usually lower than in the print mode. Sleep modes are stand-by modes in which the device is more or less ready for operation i.e. it can more or less fast return to print mode.↑ Ready mode and energy-saving modes are examples of sleep modes. With respect to the Blue Angel requirements the sleep modes are to be categorized according to Appendix 5, i.e. they shall be delimited from each other.

Note: The sleep modes include, for example, the modes „sleep" and „stand-by", as described by Energy Star 10'2005[16].

3.4.1.15 Ready Mode (corresponding to Energy Star 10'2005 definition of „Ready" mode [16], here, however, limited to ↑ print mode): The sleep mode Z_a in which the product is not producing output, has reached operating conditions, has not yet entered an ↑ energy-saving mode and is ready to return to print mode with minimum delay. All device functions can be activated in this mode and the device must be capable of returning to print mode by responding to the use of input options of the device. Input option include external electrical signals (as, for example, data network signals, fax input or remote control) and direct technical user interventions (such as activation of a switch or button).

Note: "Ready" is the power state that the device enters immediately after the ↑ end of the printing process.

3.4.1.16 Energy-Saving Mode: Sleep mode (Z_b, Z_c, …) where the device goes to after expiry of an ↑ activation time (t_{bA}, t_{cA}, …) and where its ↑ power consumption (P_b, P_c, …) is usually lower than in ready mode.

Note: At the end of the printing process devices usually switch to "ready" mode first and later to an energy-saving mode. Some devices have just one energy-saving mode while others have multiple energy-saving modes of different power consumption levels. And again others have no energy-saving mode at all. These devices stay in „ready" mode where power consumption is mostly very low so that the ready mode fulfils the function of the energy-saving mode.

3.4.1.17 Plug-in Off Mode (corresponding to Energy Star 10'2005 definition of the „off" mode[16]): The power state that the product enters when is has been manually or automatically switched off but is still plugged into and connected to the mains. This mode is ended by an input, for example via a switch or a timer which brings the unit into ↑ ready mode. If this state is manually activated by the user, it is often referred to as "Manual Off", and if it is activated by an automatic or predetermined signal (e.g. activation time or clock), it is often referred to as "Auto Off".

Device Functions and Properties

3.4.1.18 Primary Functions: Primary functions include † printing, † copying, † digitizing and transmitting of data as well as † sending and receiving of electronic messages and faxes.

3.4.1.19 Printing: see definition in paragraph 2.

3.4.1.20 Copying: see definition in paragraph 2.

3.4.1.21 Digitizing and transmission of data: see definition in paragraph 2.

3.4.1.22 Sending and receiving of electronic messages and faxes, see definition in paragraph 2.

3.4.1.23 Multifunctionality: The capability of a device to perform at least two † primary functions at least one of which must be † copying or † printing.

3.4.1.24 Output Speed S_{SW}: Output speed S_{SW} gives the number of A-4 size pages a device can print per minute in black and white according to manufacturer's information if data output is performed on paper or similar materials. If the device offers the primary function "printing" the output speed for this function shall be used. If not, the output speed in the primary function "copying" shall be used. For ink jet devices, the standard mode (usually preset) >>shall be chosen.

3.4.1.25 Output Speed S_F: Output speed S_F gives, analogously to output speed S_{SW} , the number of A-4 size pages a device can print in colour according to manufacturer's information if data output is performed on paper or similar materials. For ink jet devices the standard mode (usually preset) >>shall be chosen.

3.4.1.26 Electrophotographic colour devices of Group A: Devices whose output speed in colour print mode (S_F) is far lower than in monochrome print mode (S_{SW}). The following formula shall apply:

$$\mathbf{S_F < 0.9 \times S_{SW}}$$

3.4.1.27 Electrophotographic colour devices of Group B:

Devices whose output speed in colour print mode (S_F) is almost or exactly the same as in monochrome print mode (S_{SW}). The following formula shall apply:

$$\mathbf{S_F \geq 0.9 \times S_{SW}}$$

3.4.1.28 Power consumption of the device in the ↑ sleep modes, i.e. ready mode (P_a), in the energy-saving modes (P_b, P_c and so on) as well in ↑ Plug-in Off mode (P_S): The basis for evaluating a device is its total power consumption, i.e. the effective power consumption measured at the power supply of the device. The power consumption of the device that must meet the limit curve shall not include the power consumption of ↑ accessories but it shall include the power consumption of controllers. Please see the information contained in Appendix 6.

3.4.1.29 Activation time (t_{aA}, t_{bA} etc.): The time that elapses after the end of the ↑ printing process until the device enters a ↑ sleep mode. (Note: With respect to the ↑ delivery status this corresponds to the Energy Star 10'2005 definition of „default delay time" [16].

3.4.1.30 Return time (t_{iR}): The amount of time it takes to return from an ↑ energy-saving mode to ↑ ready mode. The return time is to be determined as difference between

a) time required to complete a certain print job from energy-saving mode Z_i and

b) time it takes to complete the same job from "Ready" mode Z_a .

(by analogy with Energy Star 3'2005 definition of „recovery time from sleep" [19])

Note: The return time differs from the recovery time as specified in RAL-UZ 114 Basic Award Criteria.

3.4.2 Summary of Requirements

3.4.2.1 The ↑ return time, the time it takes to return from a low-power consumption mode to "Ready" mode, is limited; see para. 3.4.3.

3.4.2.2 The ↑ power consumption curve of the device for the time elapsing after the end of the printing process, i.e. in the sleep modes, may not exceed a specified limit curve. This limit curve is determined by the power consumption values (see para. 3.4.4) and for times (see para. 3.4.5). Appendix 5 shall be taken into account when grading the ↑ sleep modes.

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[19] „Energy Star Qualified Imaging Equipment – Revised Terminology and Definitions", 16 March 2005

- The device must meet the limit curve in any case, i.e. as soon as it has completed any † primary function – not only † copying or † printing – and does not perform any other primary function.
- This shall also apply if the device is connected to a data network. Signals received via the data network which do not serve the performance of a † primary function [20], may neither „weak up" the device, i.e. allow the device to enter a higher power consumption mode nor keep it from switching according to the † activation times set.

3.4.2.3 The device must have a switch mounted in an easily accessible position in a usual setup position which can at least switch the device to † Plug-in Off mode. Easy accessibility must also be ensured if the device is upgraded – for example, with accessories. The device's power consumption may not exceed 2 watts in "Plug-in Off" mode. It must be so designed as to ensure that it may be switched to this mode at least twice a day over the normal life cycle without suffering damage.

3.4.2.4 Standard IEEE 1621 [21] should be complied with when designing switches and buttons. It is highly recommended to follow this standard already now. Future updates of these Basic Award Criteria will require compliance with the standard (update is expected to be released on 1 January 2009).

3.4.2.5 Product specific external power supplies must meet the requirements of EU Commission Guideline on External Power Supplies with regard to the efficiency level (see [22]). Their power consumption in sleep mode (see the above-named European Commission Guideline) shall not exceed the following limit value:

Limit value in watts = Power output in watts × 0.004 + 0.4 watts

3.4.2.6 † Accessories shall not affect energy-saving functions.

3.4.2.7 In † delivery status the device must be set in way that it meets all requirements described in para. 3.4.

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[20] For example: server status inquiries.

[21] http://eetd.lbl.gov/Controls/1621

[22] Code of Conduct on Efficiency of External Power Supplies - Version 2; 24. 1. 2004; http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm; see table 3

3.4.2.8 Measurements shall be taken in accordance with the requirements as specified in Appendix 6. Said Annex lists – to the extent appropriate - the Energy Star Test Methods as measuring methods.

3.4.3 Limit Values of Return Times t_{2R} and t_{3R}

If a device is capable of performing the primary function copying the limit value of the ↑ return time refers to the return to ↑ ready mode of the primary function copying. If not, it refers to the return to ready mode of the primary function printing. Return time values shall be determined in accordance with Appendix 6.

The return time limit t_{2R} (see Table 3-1) refers to ↑ sleep mode Z_i where the device runs immediately after expiry of the time given in Table 3-3 for t_{2A} , i.e. at the beginning of limit level 2.

Example: In Fig. 2, this would be "Warm start" mode for device A (upper dotted line).

If right at that moment the device switches between two sleep modes it must meet the return time limit from that sleep mode to which the device switches.

Example: In Fig. 2, this would be the „Off" mode for device B (middle dotted line).

However, if at that moment the device runs in „Ready" mode Z_a, the following should be considered: According to para. 3.4.1.30 return time is the time the device needs to return form one energy-saving mode to „Ready" mode. As the device, in the case described, runs already in „Ready" mode the requirement for the return time is dropped.

Example: In Fig. 2 this would apply to the „Ready" mode for device C (lower dotted line).

This correspondingly applies to the return time limit t_{3R} ; The reference value is t_{3A}.

Examples: With respect to examples A to C shown in Fig. 2 this means: The requirement for return time t_{3R} is to be met from the following sleep modes: Example A (upper line): „energy-saving mode" and example B (middle

line): „Off' mode. Here too, the requirement is dropped for „ready" mode in example C (lower line).

Fig. 2: Return Time Limits

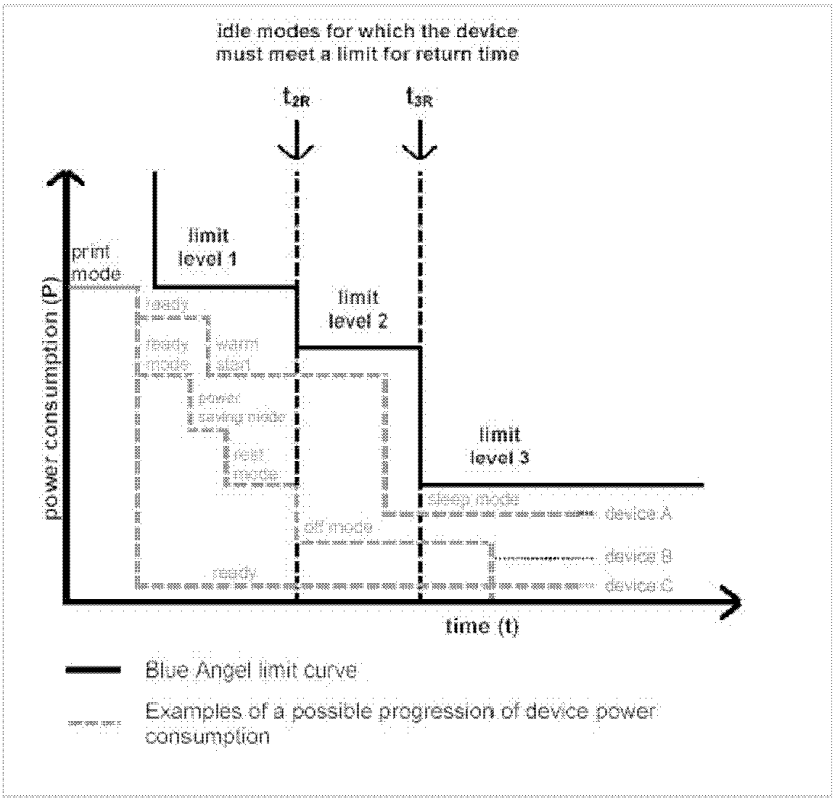
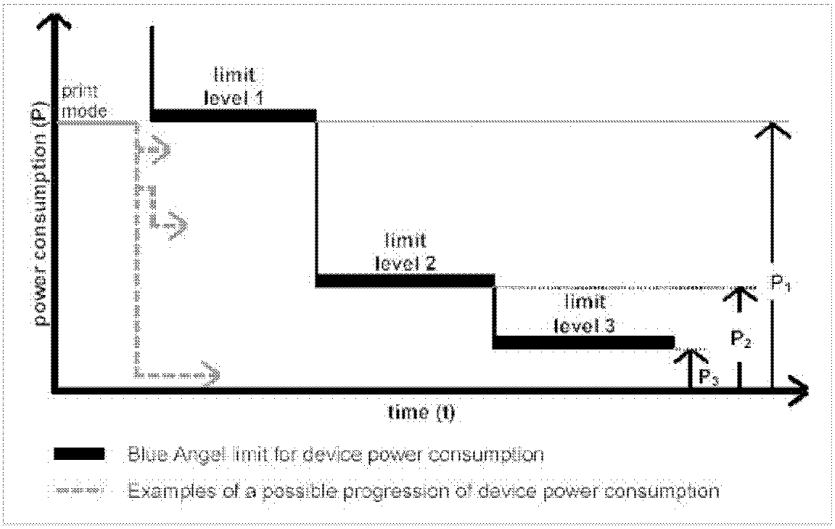


Table 3-1 Return Time Limits

	Values in Seconds	
	Limit level 2 t_{2R}	Limit level 3 t_{3R}
Electrophotographic devices	$0.4 \times S_{SW} + 10$ (maximum 35 sec.)	$0.5 \times S_{SW} + 30$ (maximum 60 sec.)
Ink jet devices	5	5

3.4.4 Power Consumption Limits P_1, P_2 and P_3

Fig. 3: Shape of Power Consumption Limit



The power consumption limits apply to copy mode as well as to print mode. Power consumption values shall be determined in accordance with Appendix 6.

Office equipment with print functions are available in numerous versions and specifications – depending on which of the following „modules" are used:

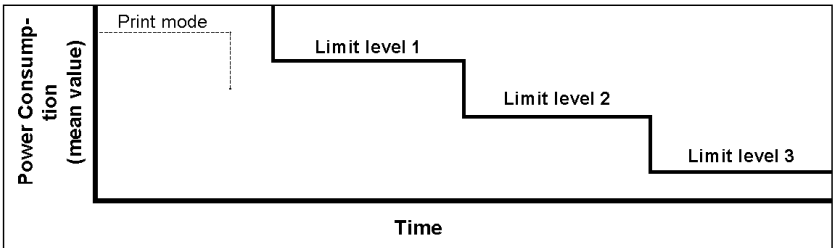
- printing technology: electrophotographic or ink,
- print colours: only black and white or black-and-white and colour as well as
- function: copying, printing, digitizing and transmitting of data as well as sending and receiving of electronic messages and faxes.

That is why the power consumption limits P_i, i.e. P_1, P_2 and P_3, have not been individually determined for all specifications possible. It is rather so that the limits too are composed of „modules“. They are listed in Table 3-2.

The power consumption limits P_i for any device (i.e. P_1, P_2 and P_3) may be determined from the values listed in Table 3-2. In dependence of the output speed S_{SW} a limit P_i is calculated using the formula $P_i = m \times S_{sw} + b$. A basic value for all devices exists for each *m* and *b* (line 1: $P_i = 0.3 \times S_{sw} + 2$). Depending on printing technology and function/functional units of the device values are added for *m* and/or *b* which each make a sum and thereby determine the limit value:

$$\mathbf{P_i = \Sigma m \times S_{sw} + \Sigma b}$$

Table 3-2 Power Consumption Limit



Limits P_i are functions of output speed S_{SW} according to the formula

$$\mathbf{P_i = m \times S_{sw} + b}.$$

Factors *m* and *b* are first replaced by the basic values given in line 1. If the device possesses functional units and/or printing technologies or functionalities in its delivery status that are listed in lines 2 to 7 the values given there for *m* and *b* are added.

Limit value	P_i Values in Watts					
	Limit level 1		Limit level 2		Limit level 3	
	$P_1 = \Sigma m \times S_{sw} + \Sigma b$		$P_2 = \Sigma m \times S_{sw} + \Sigma b$		$P_3 = \Sigma m \times S_{sw} + \Sigma b$	
	m	b	m	b	m	b
1. Devices with print unit (i.e. all devices)	**0.3**	**2**	**0.3**	**2**	**0.3**	**2**
Bonus for individual functional units						
2. ↑ Scan unit	—	**5**	—	**5**	—	—

Limit value	P_i Values in Watts					
	Limit level 1		Limit level 2		Limit level 3	
	$P_1 = \Sigma m \times S_{sw} + \Sigma b$		$P_2 = \Sigma m \times S_{sw} + \Sigma b$		$P_3 = \Sigma m \times S_{sw} + \Sigma b$	
	m	b	m	b	m	b
3. † Telephone modem and/or † LAN interface	**—**	**15**	**—**	**15**	**—**	**10**
Bonus for individual functions						
4. † Multifunctionality of electrophotographic devices	**2.2**	**5**	**2.2**	**5**	**—**	**—**
Bonus for individual printing technologies						
5. Electrophotography, monochrome printing only	**2.5**	**20**	**1.5**	**—**	**0.1**	**—**
6. Electrophotography, monochrome and colour printing, † group A	**2.5**	**70**	**2.5**	**—**	**0.1**	**—**
7. Electrophotography, Monochrome and colour printing, † Group B	**3.0**	**100**	**3.0**	**50**	**0.1**	**10**
Example: For a multifunction device, electrophotographic, colour printing, Group B and the functions printing, copying as well as sending an receiving of faxes (via telephone modem) the limits P_i are calculated as follows:						
1. Devices with print unit	0.3	2	0.3	2	0.3	2
2. Scan unit	—	5	—	5	—	---
3. Telephone modem and/or LAN interface	—	15	—	15	—	10
4. Multifunctionality	2.2	5	2.2	5	—	—
7. Electrophotography, monochrome as well as colour printing, Group B	3.0	100	3.0	50	0.1	10
Total:	5.5	127	5.5	77	0.4	22
Limit values:	**$P_1 = 5.5 \times S_{sw} + 127$**		**$P_2 = 5.5 \times S_{sw} + 78$**		**$P_3 = 0.4 \times S_{sw} + 22$**	

Appendix 5 lists the limits for a great number of possible device specifications.

3.4.5 Time Limits t_{1A}, t_{2A} and t_{3A} as well as Activation Times t_{aA}, t_{bA} etc.

In the ↑ delivery status the ↑ activation times shall be set in a way that the device does not exceed the limit curve. The latter results from the power consumption limits given in paragraph 3.4.4 as well as the times listed in Table 3-3.

If user can change the activation time of individual sleep modes a fixed upper limit value not exceeding 240 minutes shall be chosen for this setting range. It is strongly recommended to chose those values from among the values listed in Table 3-4 which are to become binding when these Basic Award Criteria will be updated (update is expected to be released on 1 January 2009).

Activation time values shall be determined in accordance with Appendix 6.

Fig 4: Shape of Limit Level and Activation Time Curves

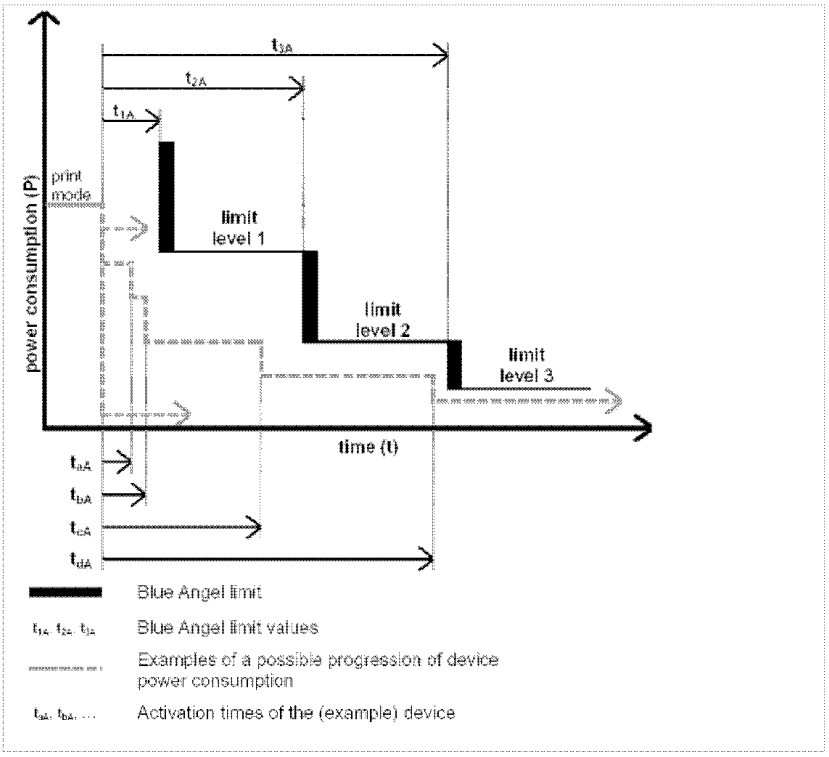


Table 3-3 Limit Curve: Time Limits

all devices with an output speed S_{SW} of	t_{1A}	t_{2A}	t_{3A}
> 0 ... 5 pages/minute	3	5	10
> 5 ... 10 pages/minute	5	10	15
> 10 ... 20 pages/minute	5	10	20
> 20 ... 30 pages/minute	5	10	30
> 30 ... 40 pages/minute	5	10	45
> 40 pages/minute	10	15	60

Table 3-4 Device: Upper Limit of the User-Settable Activation Times Range t_{iA}

These values apply to sleep mode Z_i where the device runs if time t_{iA} has elapsed after the ↑ end of the printing process.

all devices with an output speed S_{SW} of	value to be met; (recommended value expected to become binding as of 1 January 2009 in brackets)		
	t_{1A}	t_{2A}	t_{3A}
> 0 ... 30 pages/minute	—	240 (60)	240 (120)
> 30 pages/minute		240 (120)	240 (180)

Compliance Verification:

- *By completing the forms in Appendix 1 and Appendix 8a the applicant shall give all equipment data which are crucial for the applicability of requirements. Amongst others whether or not the product offers black-and-white and/or colour printing, what are its primary functions as base unit and, if applicable, after upgrading; apart from that the equipment values for the above-mentioned parameters of power consumption, activation times as well as return times. In addition, the applicant shall state for accessories whether or not they are powered via*

(base) unit or a separate power supply. Apart from that, the applicant shall state in Appendix 8a, that the product has been shipped to the laboratory in a condition corresponding to the normal delivery status, above all, with regard to activation times and other parameters influencing power consumption/energy consumption.

- *With respect to power consumption and return time measurements according to Annex 6 the applicant shall submit the measurement report (Appendix 8b).*
- *With respect to indication of energy consumption as required according to Annex 7 pursuant to Energy Star the applicant shall submit the respective measurement report (Appendix 8c).*
- *If the device bears the Energy Star mark and if the measurement report on energy consumption does not already include the other power consumption measurements, as required by Energy Star, the applicant shall submit the corresponding measurement report for comparison purposes (Appendix 8d).*
- *To the extent that user information, as required by Annex 7, are not contained in the Data and Information Sheet (Appendix 12) the applicant shall (only) submit the respective excerpts from the Product Documentation (Appendix 13).*

3.5 Noise Emissions

The declared A-weighted sound-power level L_{WAd} shall be determined in dB(A) on the basis of EN ISO 7779:2001 (corresponds to ISO 7779:1999) in combination with ISO 9296:1988.

Noise measurements shall be conducted at operating temperature, during maximum noise operation of the base unit (usually at maximum print speed) and without additional accessories (e.g. sorting units).

Devices of identical design which differ in their maximum (attainable) printing speeds shall be tested in all configurations in which they are to be offered with reference to the Blue Angel.

The printed sheet according to image C2 of EN ISO 7779:2001 shall serve as test page for monochrome printing or copying.

Devices capable of multiple colour printing shall additionally be tested in full colour mode in the same way as described for monochrome printing. This shall be done by using the colour test page according to Annex 9 to the Basic Award Criteria (taken from JBMS-74-1).

A-4 size paper having a weight per unit area of 70 to 80 g/m^2 shall be used for printouts.

The limit value $L_{WAd,lim,bw}$ for monochrome printing shall be determined in dependence of the operating speed S_{bw} given to one decimal place according to the following formula:

$$L_{WAd,lim,bw} = (59 + 0.35 * S_{bw})\ \text{dB(A)}$$

$L_{WAd,lim,bw}$ = A-weighted sound-power level in dB(A) for monochrome printing to be complied with, given to one decimal place,

S_{bw} = operating speed for monochrome printing in pages per minute.

Accordingly, the following applies to the limit $L_{WAd,\ lim,co}$ for colour printing on parallel systems

$$L_{WAd,lim,co} = (61 + 0.30 * S_{co})\ \text{dB(A)}$$

$L_{WAd,lim,co}$ = A-weighted sound-power level in dB(A) for colour printing to be complied with, given to one decimal place,
S_{co} = operating speed for colour printing in pages per minute.

For serial electrophotographic colour devices with $S_{co} \leq 0.5\ S_{bw}$ the sound power level shall be determined and indicated. For assessment purposes compliance with $L_{WAd,lim,bw}$ for monochrome printing with printing speed S_{bw} shall be considered exclusively.

On ink jet devices the L_{WAd} for colour test page printing can be determined in standard print mode (usually preset). $L_{WAd,lim,co}$ shall be complied with. However, the device shall be set to maximum print speed when testing during monochrome printing.

The declared A-weighted sound-power level L_{WAd} may not exceed the limit $L_{WAd,lim,bw}$ or $L_{WAd,lim,co}$ in the respective print mode. In addition, for Blue-Angel-marked devices L_{WAd} may generally not exceed 75.0 dB(A) (noise limit for office equipment).

At least three devices have to be tested in order for the sound power level to be considered as declared. If the noise emission measurement can be performed on one device only the following formula may be used by analogy with ISO 9296 as a substitute to determine the declared A-weighted sound-power level L_{WAd}.

$$L_{WAd} = L_{WAE} + 3\ \text{dB(A)}$$

L_{WAE} = sound power level determined by single measurement in dB(A).

The following specific requirements shall be taken into account in the testing process:

Printer:

- The measurement time covers the time from the beginning of printing (including preparation of printing, e.g. paper loading and positioning of the print heads) to the output of the sixth page of the standard document.

- The measured values are averaged over this period.
- The declared A-weighted sound-power level L_{WAd} shall be recorded to one decimal place.
- Measurement of the operating speeds S_{bw} and S_{co} in pages per minute shall be performed and recorded by the testing laboratory in the same operating mode as the noise measurement (maximum print speed). Printout counting shall begin after delivery of the first page and end after one minute. Only complete printouts shall be taken into consideration.

Multifunction Devices and Copiers:

- Notwithstanding DIN EN ISO 7779:2002 measurement and determination of the characteristic L_{WAd} shall be conducted for such devices during the combined scanning and printing process. Following the input of the test page via the flat-bed scanner (if available) the measured value is averaged during scanning and the subsequent printing of 6 copies of the scanned standard document.
- The measurement time covers the period from the beginning of the scanning process to the delivery of the last page. Pauses that influence the noise measurements of more than 3 seconds between the end of the scanning process and the beginning of the printing process shall not be included in the averaging.
- The declared A-weighted sound-power level L_{WAd} shall be recorded to one decimal place.
- Measurement of the operating speed shall be done in the same way as for printers.

For information on noise emission the L_{WAd} value measured and calculated accurate to 0.1 dB(A) (according to EN ISO 7779:2001 and ISO 9296) shall be indicated in the user documents (User Manual/Product Documents) as well as in Appendix 12 under „environment and health-related statements“. The user documents of devices concerned shall additionally include a clear notice stating that devices with L_{WAd} > 63.0 dB(A) should not be placed in an office work area but in a separate room.

Consequently, the user information according to paragraph 4 (Appendix 12) must include the following wording:

„Office equipment with L_{WAd} > 63.0 dB (A) is not suitable for use in rooms where people do primarily intellectual work. Such equipment should be placed in separate rooms because of the noise emission."

The wording shall be binding with respect to $L_{WAd,bw}$.

Compliance Verification:

The applicant shall demonstrate compliance with the criteria by attaching a completed Appendix 9 to the Application. Such Appendix 9 shall be filled in and confirmed by the testing laboratory on the basis of the test report.

The testing laboratory must be accredited according to DIN EN ISO/IEC 17025 as well as according to DIN EN ISO 7779 for acoustic measurements. The test lab shall attach a copy of the valid accreditation certificates (Appendix 10). Evidence the required user information shall additionally be provided in the Information and Data Sheet (Appendix 12) according to paragraph 4.

4 Product Documents and User Information

The printed product documentation supplied along with the equipment (User Manual, Product Documents) shall be printed on chlorine-free bleached paper, preferably made of recycled paper.

As long as a printed summary is included for installation purposes these product papers may also be made available on other media (CD, DVD, internet).

In addition to the technical descriptions, the product documents shall also include essential environmental and health-related user information and must at least be published in German.

The following user information shall additionally be summarized on a separate information and data sheet which should also be printed on chlorine-free bleached paper, preferably made of recycled paper, and must at least be published in German:

Details on

- Battery types and battery take-back system according to 3.1.4,
- Usability of recycled paper according to 3.1.5,

ANNEX 3

Nordic Swan Ecolabel criteria on imaging equipment excerpt. Administrative criteria were left out.

2 Environmental requirements

If the product does not hold a valid Eco Mark or Blue Angel license, the product must fulfil the requirements in sections 2, 3 and 4.

Requirements as to analysis laboratories

The analysis laboratory used must fulfil the general requirements of standard EN ISO 17025 or have official GLP status.

The applicant's analysis laboratory/test procedure may be approved for analysis and testing if:

- sampling and analysis is monitored by the authorities, or
- the manufacturer's quality assurance system covers analyses and sampling and is certified to ISO 9001 or ISO 9002, or
- the manufacturer can demonstrate agreement between a first-time test conducted at the manufacturer's own laboratory and testing carried out in parallel at an independent test institution, and the manufacturer takes samples in accordance with a fixed sampling schedule.

2.1 General description

R3 **Description of the product**

Describe the product and how it fulfils the definition of a product eligible to carry the Nordic Eco label.

✉ Description as specified above.

2.2 Energy consumption

R4 **Energy consumption**

The energy consumption of the product must fulfil the energy requirement in Blue Angel criteria for a corresponding product. Energy consumption must be measured in accordance with the requirements described in the criteria for Blue Angel: (RAL-UZ 122, June 2006).

Or

The energy consumption of the product must fulfil the energy requirement in Energy Star criteria for imaging equipment. Energy consumption must be measured in accordance with the requirements described in the Energy Star criteria for imaging equipment (April 2007).

Further information: www.energystar.gov/index.cfm?c=ofc_equip.pr_office_equipment

EM 4-1-12 & BA 3.4

✉ A test report containing the results of the measurement of energy consumption.

2.3 Design and materials

R5 **Single plastic casing parts**

Single plastic casing parts heavier than 25 g must be made of a homopolymer or copolymer. Polymer blends (polymer alloy) are permitted.

EM 4-1-1 & BA 3.1.1

✉ • A declaration for the applied product showing that the requirement is met (Appendix 5 may be used).

• A list showing the plastic materials used (Appendix 6 may be used). Describe also all plastic part comprising of recyded or reused plastic parts.

R6 **Combined plastic casing parts**

Combined plastic casing parts heavier than 25 g must be made of four or fewer types of mutually separable polymers or polymer blends.

EM 4-1-1 & BA 3.1.1

✉ See R5.

R7 **Polymer blends in plastic components**

The variety of materials used for plastic components of similar functions must be limited to one polymer or polymer blends.

EM 4-1-1 & BA 3.1.1

✉ See R5.

R8 **Reused plastic**

At least one part heavier than 25 gram must contain reused plastic or post-consumer and pre-consumer recyded plastic.

EM 4-1-1

✉ See R5.

R9 **Labelling of plastic parts**

Plastic parts must be marked at least in accordance with DIN/ISO 11469:2000. Exemptions from this requirement are plastic parts lighter than 25 g, parts with a flat area less than 200 mm^2 and any reused parts.

EM 4-1-2 & BA 3.1.3

✉ See R5.

R10 **Subassemblies**

Subassemblies (casing parts whose entire weight exceeds 10 g) made of mutually incompatible materials must be separable or connected by separation aids or all materials used must be easily separable by means of recyding technology.

EM 4-1-1 & BA 3.1.1

✉ A declaration for the applied product showing that the requirement is met. (Appendix 5 may be used).

R11 **Special requirements as to products with combined toner cartridges.**

Products with combined toner cartridge may be accepted if the cartridge is not designed to prevent reuse.

Products must accept remanufactured toner cartridges.

In order to ensure that the toner cartridges are returned for reuse, a return system must be offered for recycling combined toner cartridges and information to user about the return system must be provided.

Combined toner cartridge: Drum, developer and toner in one unit.

EM 4-1-5 & BA 3.2.1.2

✉
- A declaration for the applied product showing that the requirement is met (Appendix 5 may be used).
- The applicant must document the existence of a functional return system and describe the structure of this system.

2.4 Plastics in casings and their components

R12 **Chlorine-based plastics**

Plastic parts over 25 grams must not contain chlorinated polymers.

Exemptions from the requirement are:

Casing parts that are demonstrably reused in accordance with R8.

EM 4-1-2 & BA 3.1.2

✉
- The applicant must submit a list of all plastic materials in plastic parts over 25 grams in casing and their components (Appendix 6 may be used).
- The manufacturer(s) of the individual plastic parts must declare that the requirement has been fulfilled (Appendix 7 may be used).

R13 **Additives**

Additives containing organohalogen compounds are not permitted. This includes flame retardants.

Flame retardants used in plastic components must be declared and characterized by their CAS numbers.

Plastics must not, at the time of application, contain additives which are assigned one or more of the following risk phrases:

- R 40 (possible risk of cancer)
- R45 (may cause cancer)
- R46 (may cause heritable genetic damage)
- R 48 (danger of serious damage to health by prolonged exposure)
- R49 (may cause cancer by inhalation)
- R60 (may impair fertility)
- R61 (may cause harm to unborn child)
- R62 (possible risk of impaired fertility)
- R63 (possible risk of harm to unborn child)

Risk phrases in accordance with EU chemical legislation (Council Directive 67/548/EEC as last amended by Commission Directive 98/98/EEC).

Exemptions from the requirement are:

Plastic parts weighing less than 25g. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Casing parts that are demonstrably reused and marked in accordance with requirement R8. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Special plastic components installed in direct vicinity of heating and fusing units. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers) , decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Process-induced technologically unavoidable impurities. The maximum allowable concentrations are 0.1 w-% in homogenous material.

Flouroorganic additives which are used to improve the physical properties of plastic, provided they are not present in concentrations greater then 0.5 weight-%.

Fluorinated plastics like for example PTFE.

EM 4-1-2 & BA 3.1.2.1

✉ The manufacturer of used plastic must declare that the requirement has been fulfilled. The manufacturer of plastic must submit a list of all used flame retardants. The list must contain complete chemical name, CAS number or according to "ISO1043-4:1998 (JIS K6899-4:2000)" and name of supplier (Appendix 7 may be used).

2.5 Materials, other dangerous substances

R14 **Batteries**

Batteries used must not contain cadmium, mercury, lead, and their compounds, except for impurities which cannot be avoided technically. Such impurities must not exceed the limiting values as specified in the EU Directives 91/157/EEC and 98/101/EEC (Battery).

EM 4-1-3 & BA 3.1.4

✉ The applicant or the manufacturer of the battery must declare that the battery fulfils the requirement (Appendix 8 may be used).

R15 **Chemicals used during production**

Chemicals containing the following substances regulated in the Montreal Protocol must not be used in the end production of the machines or in the production of circuit boards: CFCs, HCFCs, 1.1.1 trichloro-ethane or carbon-tetrachloride.

EM 4-1-16

✉ The end-manufacturer and direct suppliers (suppliers during the final stages of the supplier chain) must declare that the requirement has been fulfilled (Appendix 9 may be used).

R16 **Chlorine-based packaging materials**

Plastics used for packaging the equipment (including toner powder containers) must not contain chlorinated polymers.

EM 4-1-11 & BA 3.1.11

✉ The applicant must declare that the requirement has been fulfilled (Appendix 8 may be used).

R17 **Labelling of plastic packaging materials**

Plastics used must be marked in accordance with the currently applicable versions of the EU Directive 97/129/EEC (Packaging) or marked in accordance with ISO-11469.

EM 4-1-11 & BA 3.1.11

✉ The applicant must declare that the requirements of the Packaging Directive have been fulfilled (Appendix 8 may be used).

2.6 Other environmental requirements

R18 **Supply of spare parts**

The availability of spare parts must be guaranteed for at least five years after production of the specified ecolabelled machine comes to an end.

EM 4-1-8 & BA 3.1.8

✉ The applicant must declare that spare part will be available for at least five years after the production date of the specified ecolabelled machine (Appendix 10 may be used).

R19 **Double-sided copying**

Appliances with a maximum operating speed of more than 45 sheets per minute for A4 size paper must be equipped with automatic double-side copying (a duplex-unit). Appliances with operating speeds of 20 to 44 sheets per minute must have a double-side copy unit (duplex) as extra equipment for subsequent upgrading if the user so wishes.

EM 4-1-14

✉ The applicant must declare that the requirement is fulfilled (Appendix 10 may be used).

R20 **Traceability**

The licence holder must have a traceability system for the production of the Nordic Ecolabelled product.

✉ Description of/procedures for the fulfilment of the requirement.

R21 **Legislation and regulations**

The licence holder must guarantee adherence to safety regulations in force, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Ecolabelled product is manufactured.

No documentation is required, but Nordic Ecolabelling may revoke the licence if the requirement is not fulfilled.

3 Performance properties

R22 **Emissions**

The product must fulfil the requirement as stated in Blue Angel (RAL-UZ-122) version June 2006 or EcoMark No. 117 "Copier version 2.2" or EcoMArk No 122 "Printers Version 2.0".

Emission rates must be measured in accordance with the requirements described in Blue Angel: RAL-UZ 122 Version June 2006 or EcoMark No. 117 "Copier version 2.2" or EcoMark No 122 "Printers Version 2.0".

✉ The applicant must submit a report containing the results of the emission test according to the methods specified in RAL-UZ 122 version June 2006 (see Appendix 4) or EcoMark No. 117 "Copier version 2.2" or EcoMark No 122 "Printers Version 2.0".

R23 **Noise**

The declared A-weighted sound level LWAd must not exceed the value determined in accordance with the following formula and additionally remain below a limited value: 7.5 (B).

The formula of the limited value:

Copiers: L_{WAd}: 0.035 x CPM + 5.9 (B)

Printers: L_{WAd}: 0.035 x CPM + 5.9 (B)

Fax and MFD: L_{WAd}: 0.035 x CPM + 5.9 (B)

The noise emissions from the product must be measured in accordance with the method specified in ISO 7779 or RAL-UZ 122 and the A-weighted sound level L_{WAd} must be declared in accordance with ISO 9296 in force at the time of application.

The requirement on noise emission of equipment with a CPM above 71 is exempted from the maximum limit of 7.5B, but the L_{WAd} of these machines should be submitted for reference.

For copiers using larger paper sizes (A2 and larger), the number of sheets copied may be counted on an A4 basis (by Energy Star).

EM 4-1-3 & BA 3.5

✉ The applicant must submit a report containing the results of the noise emission test according to the methods as specified in ISO 7779 or RAL-UZ 122 and declared in accordance with ISO 9296.

2 Environmental requirements

If the product does not hold a valid Eco Mark or Blue Angel license, the product must fulfil the requirements in sections 2, 3 and 4.

Requirements as to analysis laboratories

The analysis laboratory used must fulfil the general requirements of standard EN ISO 17025 or have official GLP status.

The applicant's analysis laboratory/test procedure may be approved for analysis and testing if:

- sampling and analysis is monitored by the authorities, or
- the manufacturer's quality assurance system covers analyses and sampling and is certified to ISO 9001 or ISO 9002, or
- the manufacturer can demonstrate agreement between a first-time test conducted at the manufacturer's own laboratory and testing carried out in parallel at an independent test institution, and the manufacturer takes samples in accordance with a fixed sampling schedule.

2.1 General description

R3 **Description of the product**

Describe the product and how it fulfils the definition of a product eligible to carry the Nordic Eco label.

✉ Description as specified above.

2.2 Energy consumption

R4 **Energy consumption**

The energy consumption of the product must fulfil the energy requirement in Blue Angel criteria for a corresponding product. Energy consumption must be measured in accordance with the requirements described in the criteria for Blue Angel: (RAL-UZ 122, June 2006).

Or

The energy consumption of the product must fulfil the energy requirement in Energy Star criteria for imaging equipment. Energy consumption must be measured in accordance with the requirements described in the Energy Star criteria for imaging equipment (April 2007).

Further information: www.energystar.gov/index.cfm?c=ofc_equip.pr_office_equipment

EM 4-1-12 & BA 3.4

✉ A test report containing the results of the measurement of energy consumption.

2.3 Design and materials

R5 **Single plastic casing parts**

Single plastic casing parts heavier than 25 g must be made of a homopolymer or copolymer. Polymer blends (polymer alloy) are permitted.

EM 4-1-1 & BA 3.1.1

✉ • A declaration for the applied product showing that the requirement is met (Appendix 5 may be used).

• A list showing the plastic materials used (Appendix 6 may be used). Describe also all plastic part comprising of recyded or reused plastic parts.

R6 **Combined plastic casing parts**

Combined plastic casing parts heavier than 25 g must be made of four or fewer types of mutually separable polymers or polymer blends.

EM 4-1-1 & BA 3.1.1

✉ See R5.

R7 **Polymer blends in plastic components**

The variety of materials used for plastic components of similar functions must be limited to one polymer or polymer blends.

EM 4-1-1 & BA 3.1.1

✉ See R5.

R8 **Reused plastic**

At least one part heavier than 25 gram must contain reused plastic or post-consumer and pre-consumer recyded plastic.

EM 4-1-1

✉ See R5.

R9 **Labelling of plastic parts**

Plastic parts must be marked at least in accordance with DIN/ISO 11469:2000. Exemptions from this requirement are plastic parts lighter than 25 g, parts with a flat area less than 200 mm^2 and any reused parts.

EM 4-1-2 & BA 3.1.3

✉ See R5.

R10 **Subassemblies**

Subassemblies (casing parts whose entire weight exceeds 10 g) made of mutually incompatible materials must be separable or connected by separation aids or all materials used must be easily separable by means of recyding technology.

EM 4-1-1 & BA 3.1.1

✉ A declaration for the applied product showing that the requirement is met. (Appendix 5 may be used).

R11 **Special requirements as to products with combined toner cartridges.**

Products with combined toner cartridge may be accepted if the cartridge is not designed to prevent reuse.

Products must accept remanufactured toner cartridges.

In order to ensure that the toner cartridges are returned for reuse, a return system must be offered for recycling combined toner cartridges and information to user about the return system must be provided.

Combined toner cartridge: Drum, developer and toner in one unit.

EM 4-1-5 & BA 3.2.1.2

✉
- A declaration for the applied product showing that the requirement is met (Appendix 5 may be used).
- The applicant must document the existence of a functional return system and describe the structure of this system.

2.4 Plastics in casings and their components

R12 **Chlorine-based plastics**

Plastic parts over 25 grams must not contain chlorinated polymers.

Exemptions from the requirement are:

Casing parts that are demonstrably reused in accordance with R8.

EM 4-1-2 & BA 3.1.2

✉
- The applicant must submit a list of all plastic materials in plastic parts over 25 grams in casing and their components (Appendix 6 may be used).
- The manufacturer(s) of the individual plastic parts must declare that the requirement has been fulfilled (Appendix 7 may be used).

R13 **Additives**

Additives containing organohalogen compounds are not permitted. This includes flame retardants.

Flame retardants used in plastic components must be declared and characterized by their CAS numbers.

Plastics must not, at the time of application, contain additives which are assigned one or more of the following risk phrases:

- R 40 (possible risk of cancer)
- R45 (may cause cancer)
- R46 (may cause heritable genetic damage)
- R 48 (danger of serious damage to health by prolonged exposure)
- R49 (may cause cancer by inhalation)
- R60 (may impair fertility)
- R61 (may cause harm to unborn child)
- R62 (possible risk of impaired fertility)
- R63 (possible risk of harm to unborn child)

Risk phrases in accordance with EU chemical legislation (Council Directive 67/548/EEC as last amended by Commission Directive 98/98/EEC).

Exemptions from the requirement are:

Plastic parts weighing less than 25g. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Casing parts that are demonstrably reused and marked in accordance with requirement R8. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Special plastic components installed in direct vicinity of heating and fusing units. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers) , decaBDE or chlorinated paraffins. This exemption is still valid after EU Directive 2002/95/EC (RoHS) comes into force on July 1st 2006.

Process-induced technologically unavoidable impurities. The maximum allowable concentrations are 0.1 w-% in homogenous material.

Flouroorganic additives which are used to improve the physical properties of plastic, provided they are not present in concentrations greater then 0.5 weight-%.

Fluorinated plastics like for example PTFE.

EM 4-1-2 & BA 3.1.2.1

✉ The manufacturer of used plastic must declare that the requirement has been fulfilled. The manufacturer of plastic must submit a list of all used flame retardants. The list must contain complete chemical name, CAS number or according to "ISO1043-4:1998 (JIS K6899-4:2000)" and name of supplier (Appendix 7 may be used).

2.5 Materials, other dangerous substances

R14 Batteries

Batteries used must not contain cadmium, mercury, lead, and their compounds, except for impurities which cannot be avoided technically. Such impurities must not exceed the limiting values as specified in the EU Directives 91/157/EEC and 98/101/EEC (Battery).

EM 4-1-3 & BA 3.1.4

✉ The applicant or the manufacturer of the battery must declare that the battery fulfils the requirement (Appendix 8 may be used).

R15 Chemicals used during production

Chemicals containing the following substances regulated in the Montreal Protocol must not be used in the end production of the machines or in the production of circuit boards: CFCs, HCFCs, 1.1.1 trichloro-ethane or carbon-tetrachloride.

EM 4-1-16

✉ The end-manufacturer and direct suppliers (suppliers during the final stages of the supplier chain) must declare that the requirement has been fulfilled (Appendix 9 may be used).

R16 **Chlorine-based packaging materials**

Plastics used for packaging the equipment (including toner powder containers) must not contain chlorinated polymers.

EM 4-1-11 & BA 3.1.11

✉ The applicant must declare that the requirement has been fulfilled (Appendix 8 may be used).

R17 **Labelling of plastic packaging materials**

Plastics used must be marked in accordance with the currently applicable versions of the EU Directive 97/129/EEC (Packaging) or marked in accordance with ISO-11469.

EM 4-1-11 & BA 3.1.11

✉ The applicant must declare that the requirements of the Packaging Directive have been fulfilled (Appendix 8 may be used).

2.6 Other environmental requirements

R18 **Supply of spare parts**

The availability of spare parts must be guaranteed for at least five years after production of the specified ecolabelled machine comes to an end.

EM 4-1-8 & BA 3.1.8

✉ The applicant must declare that spare part will be available for at least five years after the production date of the specified ecolabelled machine (Appendix 10 may be used).

R19 **Double-sided copying**

Appliances with a maximum operating speed of more than 45 sheets per minute for A4 size paper must be equipped with automatic double-side copying (a duplex-unit). Appliances with operating speeds of 20 to 44 sheets per minute must have a double-side copy unit (duplex) as extra equipment for subsequent upgrading if the user so wishes.

EM 4-1-14

✉ The applicant must declare that the requirement is fulfilled (Appendix 10 may be used).

R20 **Traceability**

The licence holder must have a traceability system for the production of the Nordic Ecolabelled product.

✉ Description of/procedures for the fulfilment of the requirement.

R21 **Legislation and regulations**

The licence holder must guarantee adherence to safety regulations in force, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Ecolabelled product is manufactured.

No documentation is required, but Nordic Ecolabelling may revoke the licence if the requirement is not fulfilled.

3 Performance properties

R22 **Emissions**

The product must fulfil the requirement as stated in Blue Angel (RAL-UZ-122) version June 2006 or EcoMark No. 117 "Copier version 2.2" or EcoMArk No 122 "Printers Version 2.0".

Emission rates must be measured in accordance with the requirements described in Blue Angel: RAL-UZ 122 Version June 2006 or EcoMark No. 117 "Copier version 2.2" or EcoMark No 122 "Printers Version 2.0".

✉ The applicant must submit a report containing the results of the emission test according to the methods specified in RAL-UZ 122 version June 2006 (see Appendix 4) or EcoMark No. 117 "Copier version 2.2" or EcoMark No 122 "Printers Version 2.0".

R23 **Noise**

The declared A-weighted sound level LWAd must not exceed the value determined in accordance with the following formula and additionally remain below a limited value: 7.5 (B).

The formula of the limited value:

Copiers: L_{WAd}: 0.035 x CPM + 5.9 (B)

Printers: L_{WAd}: 0.035 x CPM + 5.9 (B)

Fax and MFD: L_{WAd}: 0.035 x CPM + 5.9 (B)

The noise emissions from the product must be measured in accordance with the method specified in ISO 7779 or RAL-UZ 122 and the A-weighted sound level L_{WAd} must be declared in accordance with ISO 9296 in force at the time of application.

The requirement on noise emission of equipment with a CPM above 71 is exempted from the maximum limit of 7.5B, but the L_{WAd} of these machines should be submitted for reference.

For copiers using larger paper sizes (A2 and larger), the number of sheets copied may be counted on an A4 basis (by Energy Star).

EM 4-1-3 & BA 3.5

✉ The applicant must submit a report containing the results of the noise emission test according to the methods as specified in ISO 7779 or RAL-UZ 122 and declared in accordance with ISO 9296.

ANNEX 4

An excerpt of the 'Green Public Procurement toolkit office IT' criteria on imaging equipment follows.

4. IMAGING EQUIPMENT

Subject matter	Subject matter
Purchase of energy efficient [printers, copiers, MFDs, scanners].	Purchase of [printers, copiers, MFDs, scanners] with low environmental impacts throughout the lifecycle.
Specifications	**Specifications**
1. Appliances [with a printing function] with a maximum operating speed of more than 45 sheets per minute for A4 size paper must be equipped with automatic double-sided copying (a duplex-unit). All other devices with a lower maximum operating speed must at least offer a manual option (copiers) or an extra software-based option (printers, multifunction devices) for double-sided printing on A4 size paper.	1. Appliances [with a printing function] with a maximum operating speed of more than 45 sheets per minute for A4 size paper must be equipped with automatic double-sided copying (a duplex-unit). All other devices with a lower maximum operating speed must at least offer a manual option (copiers) or an extra software-based option (printers, multifunction devices) for double-sided printing on A4 size paper.
2. All products must meet either the latest ENERGY STAR (available at www.eu-energystar.org) standards for energy performance. **Verification:** All products carrying the ENERGY STAR will be deemed to comply. Any other appropriate means of proof, such as a technical dossier of the manufacturer or a test report from a recognised body demonstrating that the criteria are met will also be accepted.	2. All products must meet either the latest ENERGY STAR (available at www.eu-energystar.org) standards for energy performance. **Verification:** All products carrying the ENERGY STAR will be deemed to comply. Any other appropriate means of proof, such as a technical dossier of the manufacturer or a test report from a recognised body demonstrating that the criteria are met will also be accepted.
	3. For devices with a printing function the 'Declared A-weighted Sound Level' (LWAd) according to ISO 9296, measured in accordance with ISO 7779, shall not exceed the limits set by the following formula: **LWAd: 0.035 x CPM + 5.9 (B)** Where CPM = Copies per minute. The devices shall additionally not exceed 7.5 (B) LWAd except for devices with a CPM 71. **Verification:** All products carrying any type I ecolabel fulfilling this criterion will be deemed to comply. Other appropriate means of proof will also be accepted.

	Award criteria
	Additional points will be awarded for: 1. Ease of disassembly: • Plastic parts heavier than 25g shall have a permanent marking identifying the material, in conformity with ISO 11469: 2000. • Plastic parts shall be of one polymer or compatible polymers, except for casings. **Verification:** All products carrying any type I ecolabel fulfilling this criterion will be deemed to comply. Alternatively the bidder must provide a written guarantee that this criterion will be met.
	2. Substances in plastic parts hazardous to health: Plastic parts heavier than 25g do not contain flame retardant substances or preparations that are assigned any of the following risk phrases as defined in Council Directive 67/548/EEC: • R45 (may cause cancer). • R46 (may cause heritable genetic damage). • R60 (may impair fertility). • R61 (may cause harm to the unborn child). **Verification:** All products carrying any type I ecolabel fulfilling this criterion will be deemed to comply. Other appropriate means of proof will also be accepted.
Contract performance clauses	**Contract performance clauses**
For notebooks the availability of compatible batteries and power supplies and of the keyboard and its parts shall be guaranteed for at least 3 years from the time that production ceases. **Verification:** All products carrying any type I ecolabel fulfilling this criterion will be deemed to comply. Alternatively the bidder must provide a written guarantee that this criterion will be met.	The bidder must guarantee the availability of spare parts for at least 3 years from the time that production ceases. **Verification:** All products carrying any type I ecolabel fulfilling this criterion will be deemed to comply. Alternatively the bidder must provide a written guarantee that this criterion will be met.

ANNEX 5

An excerpt of the Energy Star program requirements for imaging equipment version 1.1 follows.

Products Designated to Operate with a Type 2 DFE: For an imaging equipment product, sold with a Type 2 DFE, manufactured on or after July 1, 2009 to qualify as ENERGY STAR under the Imaging Equipment Version 1.1 specification, manufacturers should subtract the DFE's energy consumption in Ready mode for TEC products or exclude when measuring Sleep and Standby for OM products. Section 3A provides further detail on adjusting TEC values for DFEs for TEC products and Section 3B provides further detail for excluding DFEs from OM Sleep and Standby levels.

It is EPA's intent that, whenever possible, the power associated with the DFE (Type 1 or Type 2) should be excluded or subtracted from the TEC energy and OM power measurements.

Products Sold with an Additional Cordless Handset: To qualify, fax machines or MFDs with fax capability manufactured on or after July 1, 2009 that are sold with additional cordless handsets must use an ENERGY STAR qualified handset, or one that meets the ENERGY STAR Telephony specification when tested to the ENERGY STAR test method on the date the imaging product is qualified as ENERGY STAR. The ENERGY STAR specification and test method for telephony products may be found at www.energystar.gov/products.

Duplexing: Standard-size copiers, MFDs, and printers that use EP, SI, and High Performance IJ marking technologies addressed by the TEC approach in Section 3.A. must meet the following duplexing requirements, based on monochrome product speed:

Color Copiers, MFDs, and Printers

Monochrome Product Speed	Duplexing Requirement
≤ 19 ipm	N/A
20 – 39 ipm	Automatic duplexing must be offered as a **standard feature** or **optional accessory** at the time of purchase.
≥ 40 ipm	Automatic duplexing is required as a **standard feature** at the time of purchase.

Monochrome Copiers, MFDs, and Printers

Monochrome Product Speed	Duplexing Requirement
≤ 24 ipm	N/A
25 – 44 ipm	Automatic duplexing must be offered as a **standard feature** or **optional accessory** at the time of purchase.
≥ 45 ipm	Automatic duplexing is required as a **standard feature** at the time of purchase.

A. **ENERGY STAR Eligibility Criteria – TEC**. To qualify as ENERGY STAR, the TEC value obtained for imaging equipment outlined in Section 2, Table 1 above must not exceed the corresponding criteria below.

For imaging products with a Type 2 DFE, the energy consumption of the DFE, calculated per the example below, should be excluded when comparing the product's measured TEC value to the criteria listed below. The DFE must not interfere with the ability of the imaging product to enter or exit its lower-power modes. In order to take advantage of this exclusion, the DFE must meet the definition in Section 1.DD. and be a separate processing unit that is capable of initiating activity over the network.

Example: A printer's total TEC result is 24.5 kWh/week and its internal DFE consumes 50W in Ready mode. 50W x 168 hours/week = 8.4 kWh/week, which is then subtracted from the tested TEC value: 24.5 kWh/week – 8.4 kWh/week = 16.1 kWh/week. 16.1 kWh/week is then compared to the following criteria.

Note: In all of the following equations, x = Monochrome Product Speed (ipm).

TEC Table 1

Product(s): Copiers, Digital Duplicators, Fax Machines, Printers	
Size Format(s): Standard-size	
Marking Technologies: DT, Mono DS, Mono EP, Mono Stencil, Mono TT, Mono High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 15	***1.0 kWh***
15 < x ≤ 40	***(0.10 kWh/ipm)x – 0.5 kWh***
40 < x ≤ 82	***(0.35 kWh/ipm)x – 10.3 kWh***
> 82	***(0.70 kWh/ipm)x – 39.0 kWh***

TEC Table 2

Product(s): Copiers, Digital Duplicators, Fax Machines, Printers	
Size Format(s): Standard-size	
Marking Technologies: Color DS, Color Stencil, Color TT, Color EP, SI, Color High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 32	***(0.10 kWh/ipm)x + 2.8 kWh***
32 < x ≤ 58	***(0.35 kWh/ipm)x – 5.2 kWh***
> 58	***(0.70 kWh/ipm)x – 26.0 kWh***

TEC Table 3

Product(s): MFDs	
Size Format(s): Standard-size	
Marking Technologies: DT, Mono DS, Mono EP, Mono TT, Mono High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 10	***1.5 kWh***
10 < x ≤ 26	***(0.10 kWh/ipm)x + 0.5 kWh***
26 < x ≤ 68	***(0.35 kWh/ipm)x – 6.0 kWh***
> 68	***(0.70 kWh/ipm)x – 30.0 kWh***

TEC Table 4

Product(s): MFDs	
Size Format(s): Standard-size	
Marking Technologies: Color DS, Color TT, Color EP, SI, Color High Performance IJ	
Monochrome Product Speed (ipm)	Maximum TEC (kWh/week)
≤ 26	***(0.10 kWh/ipm)x + 3.5 kWh***
26 < x ≤ 62	***(0.35 kWh/ipm)x – 3.0 kWh***
> 62	***(0.70 kWh/ipm)x – 25.0 kWh***

B. **ENERGY STAR Eligibility Criteria – OM.** To qualify as ENERGY STAR, the power consumption values for imaging equipment outlined in Section 2, Table 2 above must not exceed the corresponding criteria below. For products that meet the Sleep-mode power requirement in Ready mode, no further automatic power reductions are required to meet the Sleep criterion. Additionally, for products that meet the Standby-power requirements in Ready or Sleep mode, no further automatic power reductions are required to earn the ENERGY STAR.

For imaging products with a functionally-integrated DFE that relies on the imaging product for its power, the power consumption of the DFE should be excluded when comparing the product's measured Sleep to the combined marking-engine and functional-adder criteria limits below and when comparing to the measured Standby level to the Standby criteria limits below. The DFE must not interfere with the ability of the imaging product to enter or exit its lower-power modes. In order to take advantage of this exclusion, the DFE must meet the definition in Section 1.DD. and be a separate processing unit that is capable of initiating activity over the network.

Default Delay Time Requirements: To qualify for ENERGY STAR, OM products must meet the default-delay time settings provided in Tables A through C below for each product type, enabled upon product shipment. In addition, all OM products must be shipped with a maximum **machine** delay time not in excess of four hours, which is only adjustable by the manufacturer. This maximum machine delay time cannot be influenced by the user and typically cannot be modified without internal, invasive product manipulation. The default-delay-time settings provided in Tables A through C may be user adjustable.

Table A: Maximum Default Delay Times to Sleep for Small-format and Standard-size OM Products, Excluding Mailing Machines, in Minutes

Monochrome Product Speed (ipm)	Fax Machines	MFDs	Printers	Scanners
0 - 10	5	15	5	15
11 - 20	5	30	15	15
21 - 30	5	60	30	15
31 - 50	5	60	60	15
51 +	5	60	60	15

Table B: Maximum Default Delay Times to Sleep for Large-format OM Products, Excluding Mailing Machines, in Minutes

Monochrome Product Speed (ipm)	Copiers	MFDs	Printers	Scanners
0 - 10	30	30	30	15
11 - 20	30	30	30	15
21 - 30	30	30	30	15
31 - 50	60	60	60	15
51 +	60	60	60	15

Table C: Maximum Default Delay Times to Sleep for Mailing Machines in Minutes

Product Speed (mppm)	Mailing Machines
0 – 50	20
51 – 100	30
101 – 150	40
151 +	60

Standby Requirements: To qualify for ENERGY STAR, OM products must meet the Standby power criteria provided in Table D below for each product type.

Table D: Maximum Standby Power Level for OM Products in Watts

Product Type	Standby (W)
All OM Products	1

The eligibility criteria in OM Tables 1 through 8 below address the marking engine of the product. Since products are expected to be shipped with one or more functions beyond a basic marking engine, the corresponding allowances below should be added to the marking engine criteria for Sleep. The total value for the base product with applicable "functional adders" should be used to determine eligibility. Manufacturers may apply no more than **three** Primary functional adders to each product model, but may apply as many Secondary adders as present (with Primary adders in excess of three included as Secondary adders). An example of this approach is provided below:

Example: Consider a Standard-size IJ printer with a USB 2.0 connection and a memory card connection. Assuming the USB connection is the Primary interface used during the test, the printer model would receive a functional-adder allowance of 0.5 W for USB and 0.1 for the memory card reader, for a total of 0.6 W of total functional-adder allowances. Since OM Table 2 provides a Sleep mode marking-engine criterion of 1.4 W, to determine qualification under ENERGY STAR, the manufacturer would sum the Sleep mode marking-engine criterion with the applicable functional-adder allowances to determine the maximum power consumption permitted for qualification of the base product: 1.4 W + 0.6 W. If the power consumption of the printer in Sleep mode measures at or below 2.0 W, then the printer would meet the ENERGY STAR Sleep criterion.

Qualifying Products: Table 3 – OM Functional Adders

Type	Details	Functional Adder Allowances (W)	
		Primary	Secondary
Interfaces	A. Wired < 20 MHz	0.3	0.2
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate < 20 MHz. Includes USB 1.x, IEEE488, IEEE 1284/Parallel/Centronics, RS232, and/or fax modem.		
	B. Wired ≥ 20 MHz and < 500 MHz	0.5	0.2
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate ≥ 20 MHz and < 500 MHz. Includes USB 2.x, IEEE 1394/FireWire/i.LINK, and 100Mb Ethernet.		
	C. Wired ≥ 500 MHz	1.5	0.5
	A physical data- or network-connection port present on the imaging product that is capable of a transfer rate ≥ 500 MHz. Includes 1G Ethernet.		
	D. Wireless	3.0	0.7
	A data- or network-connection interface present on the imaging product that is designed to transfer data via radio-frequency wireless means. Includes Bluetooth and 802.11.		
	E. Wired card/camera/storage	0.5	0.1
	A physical data- or network-connection port present on the imaging product that is designed to allow the connection of an external device, such as flash memory-card/smart-card readers and camera interfaces (including PictBridge).		
	G. Infrared	0.2	0.2
	A data- or network-connection interface present on the imaging product that is designed to transfer data via infrared technology. Includes IrDA.		

Type	Details	Functional Adder Allowances (W)	
		Primary	Secondary
Other	Storage	-	0.2
	Internal storage drives present on the imaging product. Includes internal drives only (e.g., disk drives, DVD drives, Zip drives), and applies to each separate drive. This adder does not cover interfaces to external drives (e.g., SCSI) or internal memory.		
	Scanners with CCFL lamps or non-CCFL lamps	-	0.5
	The presence of a scanner that uses Cold Cathode Fluorescent Lamp (CCFL) technology or a technology other than CCFL, such as Light-Emitting Diode (LED), Halogen, Hot-Cathode Fluorescent Tube (HCFT), Xenon, or Tubular Fluorescent (TL) technologies. This adder is applied only once, regardless of the lamp size or the number of lamps/bulbs employed.		
	PC-based system (cannot print/copy/scan without use of significant PC resources)	-	-0.5
	This adder applies to imaging products that rely on an external computer for **significant** resources, such as memory and data processing, to perform basic functions commonly performed by imaging products independently, such as page rendering. This adder does not apply to products that simply use a computer as a source or destination for image data.		
	Cordless handset	-	0.8
	The capability of the imaging product to communicate with a cordless handset. This adder is applied only once, regardless of the number of cordless handsets the product is designed to handle. This adder does not address the power requirements of the cordless handset itself.		
	Memory	-	1.0 W per 1 GB
	The internal capacity available in the imaging product for storing data. This adder applies to all volumes of internal memory and should be scaled accordingly. For example, a unit with 2.5 GB of memory would receive an allowance of 2.5 W while a unit with 0.5 GB would receive an allowance of 0.5 W.		
	Power-supply (PS) size, based on PS output rating (OR) **Note: This adder ONLY applies to products which fall under OM Tables 2 and 6.**	-	For PSOR > 10 W, 0.02 x (PSOR – 10 W)
	This adder applies to only those imaging products which fall under OM Tables 2 and 6. The allowance is calculated from the internal or external power supply's **rated DC output** as specified by the power supply manufacturer. (It is **not** a measured quantity). For example, a unit that is rated to provide up to 3 A at 12 V has a PSOR of 36 W and would receive an allowance of 0.02 x (36-10) = 0.02 x 26 = 0.52 W of power supply allowance. For supplies that provide more than one voltage, the sum of power from all voltages is used unless the specifications note that there is a rated limit lower than this. For example, a supply which can supply 3A of 24 V and 1.5 A of 5 V output has a total PSOR of (3 x 24) + (1.5 x 5) = 79.5 W, and an allowance of 1.39 W.		

For the adder allowances shown in Qualifying Products Table 3 above, distinctions are made for "Primary" and "Secondary" types of adders. These designations refer to the state in which the interface is required to remain while the imaging product is in Sleep. Connections that remain active during the OM test procedure while the imaging product is in Sleep are defined as Primary, while connections that can be inactive while the imaging product is in Sleep are defined as Secondary. Most functional adders typically are Secondary types.

Manufacturers should consider only the adder types that are available on a product in its as-shipped configuration. Options available to the consumer after the product is shipped or interfaces that are present on the product's externally-powered digital front-end (DFE) should not be considered when applying allowances to the imaging product.

For products with multiple interfaces, these interfaces should be considered as unique and separate. However, interfaces that perform multiple functions should only be considered once.

For example, a USB connection that operates as both 1.x and 2.x may be counted only once and given a single allowance. When a particular interface may fall under more than one interface Type according to the table, the manufacturer should choose the function that the interface is primarily designed to perform when determining the appropriate adder allowance. For example, a USB connection on the front of the imaging product that is marketed as a PictBridge or "camera interface" in product literature should be considered a Type E interface rather than a Type B interface. Similarly, a memory-card-reader slot that supports multiple formats may only be counted once. Further, a system that supports more than one type of 802.11 may count as only one wireless interface.

OM Table 1

Product(s): Copiers, MFDs	
Size Format(s): Large Format	
Marking Technologies: Color DS, Color TT, DT, Mono DS, Mono EP, Mono TT, Color EP, SI	
	Sleep (W)
Marking Engine	***30***

OM Table 2

Product(s): Fax Machines, MFDs, Printers	
Size Format(s): Standard-size	
Marking Technologies: Color IJ, Mono IJ	
	Sleep (W)
Marking Engine	***1.4***

OM Table 3

Product(s): MFDs, Printers	
Size Format(s): Large Format	
Marking Technologies: Color IJ, Mono IJ	
	Sleep (W)
Marking Engine	***15***

OM Table 4

Product(s): Mailing Machines	
Size Format(s): N/A	
Marking Technologies: DT, Mono EP, Mono IJ, Mono TT	
	Sleep (W)
Marking Engine	***7***

OM Table 5

Product(s): Printers	
Size Format(s): Small Format	
Marking Technologies: Color DS, DT, Color IJ, Color Impact, Color TT, Mono DS, Mono EP, Mono IJ, Mono Impact, Mono TT, Color EP, SI	
	Sleep (W)
Marking Engine	***9***

OM Table 6

Product(s): Printers	
Size Format(s): Standard-size	
Marking Technologies: Color Impact, Mono Impact	
	Sleep (W)
Marking Engine	***4.6***

OM Table 7

Product(s): Scanners	
Size Format(s): Large Format, Small Format, Standard-size	
Marking Technologies: N/A	
	Sleep (W)
Scanning Engine	***4.3***

OM Table 8

Product(s): Printers	
Size Format(s): Large Format	
Marking Technologies: Color DS, Color Impact, Color TT, DT, Mono DS, Mono EP, Mono Impact, Mono TT, Color EP, SI	
	Sleep (W)
Marking Engine	***14***

C. **DFE Efficiency Requirements.** The following efficiency requirements are for Digital Front End equipment that is defined in Section 1.DD. of this specification.

i. Power Supply Efficiency Requirements

Type 1 DFE Using an Internal Ac-Dc Power Supply: A DFE that gets its dc power from its own internal ac-dc power source must meet the following power supply efficiency requirement: 80% minimum efficiency at 20%, 50%, and 100% of rated output and Power Factor ≥ 0.9 at 100% of rated output.

Type 1 DFE Using an External Power Supply: A DFE that gets its dc power from its own external power supply (as defined by the ENERGY STAR V2.0 Program Requirements for Single Voltage ac-ac and ac-dc External Power Supplies) must be ENERGY STAR qualified or meet the no-load and active mode efficiency levels provided in the ENERGY STAR V2.0 Program Requirements for Single Voltage ac-ac and ac-dc External Power Supplies. The ENERGY STAR specification and qualified product list can

be found at: www.energystar.gov/powersupplies.

ii. Test Procedures

Manufacturers are required to perform tests and self-certify those models that meet the ENERGY STAR guidelines.

- In performing these tests, the partner agrees to use the applicable test procedures provided in Table 4, below.
- The test results for qualifying products must be reported to EPA or the European Commission, as appropriate.

Additional testing and reporting requirements are provided below.

Models Capable of Operating at Multiple Voltage/Frequency Combinations: Manufacturers shall test their products based on the market(s) in which the models will be sold and promoted as ENERGY STAR qualified. EPA and its ENERGY STAR Country Partners have agreed upon a table with three voltage/frequency combinations for testing purposes. Please refer to the **Test Conditions and Equipment for ENERGY STAR Imaging Equipment Products** for details regarding international voltage/frequency combinations for each market.

For products that are sold as ENERGY STAR in multiple international markets and, therefore, rated at multiple input voltages, the manufacturer must test at and report the required power consumption or efficiency values at all relevant voltage/frequency combinations. For example, a manufacturer that is shipping the same model to the United States and Europe must measure, meet the specification, and report test values at both 115 Volts/60 Hz and 230 Volts/50 Hz in order to qualify the model as ENERGY STAR in both markets. If a model qualifies as ENERGY STAR at only one voltage/frequency combination (e.g., 115 Volts/60 Hz), then it may only be qualified and promoted as ENERGY STAR in those regions that support the tested voltage/frequency combination (e.g., North America and Taiwan).

Table 4: Type 1 DFE Test Procedures

Specification Requirement	Test Protocol	Source
Power Supply Efficiency	Internal Power Supply (IPS)	IPS: http://efficientpowersupplies.epri.com/
	External Power Supply (EPS) ENERGY STAR Test	EPS: www.energystar.gov/powersupplies/

4) **Test Procedures**

Product Testing Set-up, Procedures, and Documentation: The specific instructions for testing the energy efficiency of imaging equipment products are outlined in three separate documents entitled:

- "ENERGY STAR Qualified Imaging Equipment Typical Electricity Consumption Test Procedure;"
- "ENERGY STAR Qualified Imaging Equipment Operational Mode Test Procedure;" and
- "Test Conditions and Equipment for ENERGY STAR Imaging Equipment Products."

The test results produced by these procedures shall be used as the primary basis for determining ENERGY STAR qualification.

Manufacturers are required to perform tests and self-certify those product models that meet the ENERGY STAR guidelines. Families of imaging equipment models that are built on the same chassis and are identical in every respect except for housing and color may be qualified through submission of

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