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Report:
Analysis of CO_2 emissions of reused IT products

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Beskrivning:
Elanders AB has a business that handles logistics and refurbishment of used computers. The company wanted help exploring the possible climate benefits for customers who buy refurbished computers. First of all, the company wanted to know how much greenhouse gas emissions (in CO_2 equivalents) can be avoided by refurbishing and reusing a number of standard IT products.

Metod:
The analysis was performed to estimate how much CO_2 equivalents can be avoided by refurbishing and transporting the products for reuse once or twice.

The study was based on IVL report No. B 2372, which includes a simplified life cycle inventory for different IT products, such as computers. A basic assumption is that a refurbished laptop replaces a new laptop, and thus the need to manufacture the same. It includes estimates of greenhouse gas emissions over a life cycle for different models and the benefit/difference between refurbishing a product and making a new one. The report includes estimated emissions (in CO_2 equivalents) for production (in Asia), transport and final disposal, as well as refurbishment and transport to and from refurbishment, see Table 1. Refurbishment, reuse and final disposal happen in Sweden, and the transport to and from refurbishment is calculated based on a route in south Sweden. Based on the estimated safety of the study, all figures are reported to two significant figures (tenths).

Table 1: Inventory of production cycle, processes avoided by reuse. Example laptop.

Normal production cycle	**kg CO_2- eq.**
New production	280
Transport from production	1,2
Refurbishment	-0,4
Transport to and from refurbishme	-0,5
Waste handling	1,6
Transport to waste handling	0,1
Total avoided CO2 emission	**282**

Källa: IVL rapport Nr B 2372

In order to calculate the climate impact linked to Elanders' products, all figures from the inventory were assumed, including transport to and from refurbishment. The number was reduced with the estimation of emissions for some of Elanders' own transport routes, both road and air transports. This transport was only included one way, as it was assumed that the reuse happens where the refurbishment is made, i. e. the transport will only go to Sweden. With the help of these numbers and the numbers from the IVL report, the avoided emissions for one refurbishment and reuse of different IT products were calculated. The estimates were made at carboncare.org.

For the case of two reuse cycles, it was assumed that the second reuse cycle happens near the first reuse cycle. The avoided emissions from one reuse cycle was thus doubled, with the exception of the emissions from Elanders' additional transport routes, which were only included once.

Results:

Results are calculated and presented in two significant figures (tenths) with regard to the original inventory from IVL. The results show that for almost all product types, there is a clear positive effect (avoided emissions) from refurbishment and reuse of products, and that the number increases for two reuse cycles. Refurbishing and transporting a laptop to different destinations gives great benefits (up to 280 kg CO_2 eq), which also increases when refurbished twice (up to 560 kg CO_2 eq).

The added transport routes do not change the results to any significant degree, except for the heaviest products. The longest transport route (air flight between Sweden and Sidney) affects the results enough, however, for it to visible also for e.g. a refurbished laptop (270 instead of 280 kg CO_2 avoidance for one reuse cycle). This is because the production of most products is such a big burden compared to both refurbishment and transport. For one of the heavier products, a printer, with a relatively small climate burden in the production, the longest transport (Sidney – Sweden) will however have a climate burden big enough to result in a negative climate burden for one reuse cycle, i. e. there is no climate benefit from refurbishment and reuse. With two reuse cycles, the positive effect will still be there though, even for a printer (this is because the second reuse cycle is not charged with the long transport burden).

Table 2 shows the results for all product types.

Table 2: Avoided carbon dioxide emissions per product type, original IVL number, and for four Elanders-specific transport routes. One and two reuse cycles. (kg CO_2 equivalents)

Information from IVL report			Additional transport for reuse (one way)				Adjusted Avoided emissions One refurbishment/Lifetime extention (rounded to 2 digits)				Adjusted Avoided emissions Two refurbishments/Lifetime extentions (rounded to 2 digits)			
ץ (Elanders)	Avoided CO2 emissions(KgCO2e) One refurb	wt (kg)	Stockholm to Sydney (air*)	New York to Los Angeles (air*)	Malta to Växjö (ferry/truck)	Göteborg till Umeå (truck)	Stockholm to Sydney (air*)	New York to Los Angeles (air*)	Malta to Växjö (ferry/truck)	Göteborg till Umeå (truck)	Stockholm to Sydney (air*)	New York to Los Angeles (air*)	Malta to Växjö (ferry/truck)	Göteborg till Umeå (truck)
Access point	9	0,5	4,4	1,2	0,47	0,02	4	8	8	9	13	16	17	17
Desktop	470	8,4	73,4	19,7	7,88	0,38	400	450	460	470	400	450	460	470
Laptop	280	1,6	14,0	3,7	1,50	0,07	270	280	280	280	550	560	560	560
Macbook	280	1,6	14,0	3,7	1,50	0,07	270	280	280	280	550	560	560	560
Mobile	55	0,2	1,7	0,5	0,19	0,01	53	55	55	55	108	110	110	110
Monitor	440	6,6	57,7	15,4	6,19	0,30	380	420	430	440	820	860	870	880
Network equipme	340	14	122,4	32,8	13,1	0,64	210	300	320	340	550	640	660	670
Printer	180	26	227,2	60,8	24,4	1,19	-50	120	150	180	130	300	330	350
Projector	21	2	17,5	4,7	1,88	0,09	4	16	19	21	25	37	40	42
Server	400	26	227,2	60,8	24,4	1,19	170	340	370	400	570	740	770	800
Server blades	200	5,9	51,6	13,8	5,53	0,27	150	190	200	200	360	390	400	410
Storage	340	14	122,4	32,8	13,1	0,64	210	300	320	340	550	640	660	670
Switch**	200	5,9	51,6	13,8	5,53	0,27	150	190	200	200	360	390	400	410
Tablet	140	0,7	6,1	1,6	0,66	0,03	130	140	140	140	280	280	280	280
Workstation	750	15	131,1	35,1	14,1	0,69	620	710	740	750	1370	1460	1490	1500

* Air cargo is assumed to be sent via freighter

** The Switch category has been assigned the same climate impact as Server blades.

With an assumption of 100 gram CO_2 emissions per km car drive (the limit for an environmental car in the EU is 95 g/km), each kg in the table corresponds to 10 km drive. As an example, the amount of emissions avoided by reusing a laptop once can be compared to driving a car 2800 km, and reusing a laptop twice can be compared to driving 5600 km.

In terms of trees, the reuse if a laptop corresponds to the amount of CO_2 that 12 full-grown trees are estimated to absorb during one year, and two reuse cycles corresponds to 24 trees. These numbers are based on that a full-grown tree absorbs 22 kg CO_2-equivalents per year according to EEA (2022).

Referenser

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