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Economic and environmental impacts of extending the durability of electrical and electronic equipment

Summary: Using the example of smartphones, notebooks, washing machines, televisions and e-bikes (pedelecs)

Commissioned by: The Federation of German Consumer Organisations (vzbv), Berlin

Ina Rüdenauer, Siddharth Prakash

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Download: Full study (in German) is available on: - https://www.vzbv.de/pressemitteilung/studie-zu-langlebigkeit-von-produkten-qualitaet-zahlt-sich-aus; and

https://www.oeko.de/presse/archiv-pressemeldungen/presse-detailseite/2020/langlebige-produkte-schuetzen-das-klima-sparen-geld

Summary[1]

Introduction and objectives

For some years now, there have been growing indications that the lifespan and useful life of electric and electronic products are becoming shorter. Technical defects are not the only reason why devices are now replaced more quickly than they used to be. Other reasons include software-related obsolescence and the desire for newer devices with more or better functionality (Prakash et al. 2016c). This means that durable products and consumers who (want to) use their devices for a long time are actually two sides of the same coin. Both product manufacturers and consumers have a responsibility to ensure that products are used for as long as possible.

If devices stop working and it is not possible or financially viable to repair them, particularly when they are still fairly new, consumers are adversely affected because they have to buy a replacement. Products with a long lifespan and longterm usability are also environmentally advantageous in terms of resource consumption and global warming potential (see Prakash and Rüdenauer (2018), for example).

Lifespan and repairability have only recently begun to be factored into product policy. In 2019, for example, minimum requirements regarding reparability and the availability of spare parts were incorporated for the first time into the eco-design regulations for six product groups (see ECOS (2019), for example).

The trend for shorter-lived products goes against the wishes of many consumers who want to be able to use their products for longer.

Against this background, the study presented here tries to answer the questions below in respect of the following product groups: washing machines, laptops, smartphones, televisions and electric bikes:

- What do consumers specifically expect with regard to the lifespan of certain products?
- What would be the economic advantages for consumers if useful lives matched their expectations?
- How would this help to combat climate change?

Methodology

The first step was to research the average lifespans of the product groups of washing machines, laptops, smartphones and televisions and the lifespans that consumers want. This information was then used to define two scenarios for the comparison[2]:

[1] This document only provides the English summary of the study “Economic and environmental impacts of extending the durability of electrical and electronic equipment”, which was commissioned to the Öko-Institut by the The Federation of German Consumer Organisations (vzbv), Berlin. Full study (in German) is available on: - https://www.vzbv.de/pressemitteilung/studie-zu-langlebigkeit-von-produkten-qualitaet-zahlt-sich-aus; and https://www.oeko.de/presse/archiv-pressemeldungen/presse-detailseite/2020/langlebige-produkte-schuetzen-das-klima-sparen-geld

[2] The scenarios for the electric bikes product group (pedelecs) were not defined in the manner described here for the other product groups.

- Status quo scenario: current average situation
- Longer lifespan and useful life scenario

For the two baseline scenarios, the global warming potential (kg CO_2 equivalents) caused over the entire lifetime and the costs for consumers (lifecycle costs, LCCs) were determined and compared over a particular assessment period.

The results were calculated at three levels: level 1 (for the individual user), level 2 (for the whole of Germany, over the assessment period) and level 3 (for the whole of Germany, annual).

The following parameters of relevance to the calculation were researched/determined for the product groups: purchase prices, climate impact of the manufacturing process, consumption data, device efficiency and repairs.

The costs and the global warming potential of distributing, delivering and disposing of the devices were not taken into consideration. The global warming potential of delivering spare parts, the installer's travel and the consumer's journey to the repair shop were not considered either.

In addition to the baseline scenarios, the influence of certain parameters on the results was examined using sensitivity analyses or alternative scenarios. The territory covered by the study was Germany. Assumptions were fairly conservative on the whole. The results of the study should be seen as minimum values that, depending on the circumstances, could prove to be more positive in terms of the longer lifespan and useful life that consumers want.

Data and assumptions

The calculations were carried out for a total of five product groups (washing machines, laptops, smartphones, televisions and electric bikes). The two baseline scenarios and the sensitivity analysis were defined for each product group using assumptions that, where possible, were based on existing studies. The comparisons were conducted on the basis of 'typical' products.

Unlike the calculations for the other product groups, in which the actual current situation (status quo scenario) and a hypothetical scenario on the basis of the lifespan wanted by consumers were defined, a best-case/worst-case estimate was made for electric bikes. This is firstly because of the relatively poor availability of data on, for example, average useful life, the lifespan of the battery and the lifespan wanted by consumers and secondly because the market is still expanding very rapidly. Electric bikes have only been in use on a meaningful scale in the past five to eight years. In that time, the technology has evolved very quickly and continues to do so. Market share is growing at a fast pace too. Another important question in this context is how the budget pedelecs offered by discounters and other, probably short-lived new designs, measure up against brand-name bikes in terms of green credentials and costs.

Results

Table 1 shows the savings and differences per device/user over the assessment period as a result of extending the useful life compared with the status quo scenario. It is important to note that the savings for global warming potential and lifecycle costs relate to different time frames because the lifespan and useful life wanted by consumers vary for each device.

Table 1: Saving/differences per device/user over the assessment period

	Assessment period	Climate impact (global warming potential)	Lifecycle costs
Washing machines (12 vs. 17 years)	17 years	-59 kg CO_2e	-€ 43
Laptops (5 vs. 10 years)	10 years	-197 kg CO_2e	-€ 295
Smartphones (2.5 vs. 7 years)	7 years	-98 kg CO_2e	-€ 242
Televisions (6 vs. 13 years)	13 years	-657 kg CO_2e	-€ 13
Electric bikes (best case/worst case scenario) (4 vs. 15 years)	15 years	-211 kg CO_2e	-€ 50 to -€ 3,800
Electric bikes (10 vs. 15 years) (extended vs. Average lifespan and useful life)	15 years	-22.5 kg CO_2e	-€ 650

Source: Öko-Institut e.V.

The results in the sensitivity analyses/alternative scenarios deviate from the results shown here for the baseline scenarios in different ways. Firstly, it became clear that a very short lifespan and useful life (e.g. washing machines and electric bikes) result in much higher global warming potential than an average or longer lifespan and useful life. Secondly, purchase costs vary significantly. Consequently, the total costs of a longer lifespan and useful life may be higher than the total costs of an average or short lifespan and useful life, depending on the purchase price.

Table 2 shows the savings/differences extrapolated for the whole of Germany over the assessment period in the baseline scenarios. The figures reflect the differences if all the devices used by consumers had a longer rather than average lifespan and useful life. The results were not extrapolated for the electric bikes product group (pedelecs).

Table 2: Extrapolation: savings/differences in Germany over the entire assessment period

	Assessment period	Climate impact (global warming potential)	Lifecycle costs
Washing machines (12 vs. 17 years)	17 years	-2.42 million t CO_2e	-€ 1,798 million
Laptops (5 vs. 10 years)	10 years	-8.60 million t CO_2e	-€ 12,835 million
Smartphones (2.5 vs. 7 years)	7 years	-6.32 million t CO_2e	-€ 15,668 million
Televisions (6 vs. 13 years)	13 years	-26.41 million t CO_2e	-€ 543 million

Source: Öko-Institut e.V.

Table 3 shows the annual savings/differences extrapolated for the whole of Germany in the baseline scenarios. A longer lifespan and useful life for the four product groups could mean total savings of almost four million tonnes of CO_2e per year.

This is equivalent to the annual greenhouse gas emissions of around 1.8 million cars[3] or roughly 0.5 percent of Germany's annual greenhouse gas emissions (2019: 805 million t CO_2).[4]

Table 3: Extrapolation per year: annual savings/cost differences (LCCs) in Germany

	Climate impact (global warming potential)	Equivalent number of cars	Lifecycle costs
Washing machines (12 vs. 17 years)	-0.14 million t CO_2e	-66,000	-€ 106 million
Laptops (5 vs. 10 years)	-0.86 million t CO_2e	-405,600	-€ 1,283 million
Smartphones (2.5 vs. 7 years)	-0.90 million t CO_2e	-424,500	-€ 2,238 million
Televisions (6 vs. 13 years)	-2.03 million t CO_2e	-957,400	-€ 42 million
	-3.93 million t CO_2e	**-1,853,500**	**-€ 3,669 million**

Source: Öko-Institut e.V.

Conclusions

Climate impact:

- Despite very conservative assumptions, the global warming potential of all the products is lower for a longer lifespan and useful life than for an average or even very short lifespan and useful life. The results can be regarded as reliable, especially given the conservative approach. From an environmental perspective, an extended lifespan and useful life is very desirable.
- In the case of washing machines and electric bikes (pedelecs), it is clear that extending the lifespan and useful life beyond the current average apparently only generates small savings. Given the aforementioned very conservative assumptions, it is likely that the savings have tended to be underestimated.
- In the case of washing machines and electric bikes, it is likewise clear that a very short lifespan and useful life result in much higher global warming potential than an average or longer lifespan and useful life.

Lifecycle costs:

- In most cases, the lifecycle costs incurred by consumers for a longer lifespan and useful life are lower than for an average lifespan and useful life. However, purchase costs in particular vary significantly. It is therefore difficult to make definitive statements and, depending on the purchase price, the total costs for a longer lifespan and useful life may be higher than the total costs for an average or short lifespan and useful life. As a rule of thumb, the bigger the difference between the purchase prices of long-lasting and short-lived product variants, the smaller the financial benefit for the consumer of a longer lifespan and useful life.

[3] The equivalent number was based on average CO2 emissions of 155.9 g/km (Statista (2020a)) and annual driving distances of 13,600km (see German Federal Motor Transport Authority (KBA) 2020).

[4] https://www.bundesregierung.de/breg-de/aktuelles/bilanz-umweltbundesamt-1730880 (last downloaded on 20 October 2020).

Repairs are another important factor besides the purchase price because they usually make up a – sometimes significantly – higher proportion of the total costs than the proportion of the climate impact attributable to repairs during the lifecycle.

- Across all product groups, there are cost savings in respect of the basic variants. Overall, products with a longer lifespan and useful life are also financially advantageous for consumers.

Recommendations:

- Analysis of even a relatively small selection of products currently used by consumers shows that products with a longer lifespan and useful life are better for the environment and would make a considerable contribution to achieving the climate change targets that have been set. Moreover, a longer lifespan and useful life is usually financially acceptable to consumers. The aim should thus be to manufacture products that are as durable and easy to repair as possible, and for consumers to buy such products and have them repaired if they develop defects.

- To achieve this aim, various measures are needed that, taken together, would help to create inherently longer-lasting products, facilitate repairs and tip the balance between the cost of a new purchase and the cost of repair in favour of repair. Such measures could include:

  – Minimum requirements, e.g. regarding durability, repairability and warranty commitments. Initial efforts to implement such requirements can be found in the EU's eco-design regulations (Directive 2009/125/EC; see also ECOS (2019)). It is vital that these efforts are continued and expanded.

  – Economic instruments: Possibilities include reducing the VAT on repair services, making repair costs tax deductible, encouraging the procurement of durable, repairable, reconditioned and second-hand devices by the public sector and, in general, internalising external environmental costs.

  Firstly, such measures would help to counteract the manufacturing and marketing of inherently short-lived products. Secondly, they would make repair services cheaper. This would help to mitigate the effect of high repair costs in Europe relative to the price of new devices, which are often manufactured in low-wage countries.

At the same time, it is important to inform and educate consumers about the environmental and economic impact of a longer lifespan and useful life. Many consumers already want products to have a long lifespan and useful life.

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