FULL REPORT

COOLPRODUCTS
DON'T COST THE EARTH

coolproducts for a cool planet

RIGHT TO REPAIR

EEB European Environmental Bureau

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EEB European Environmental Bureau

The EEB is the largest and most inclusive network of environmental citizens' groups in Europe. Our 150 members from 35 countries cooperate across a uniquely broad range of issues. Together, we advocate for progressive policies to create a better environment in the European Union and beyond.

An International non-profit Association
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RIGHT TO REPAIR

The Right to Repair campaign advocates in the EU for longer-lasting products that can be easily repaired instead of being replaced.

coolproducts for a cool planet

The Coolproducts campaign brings together policy and technical experts to ensure product policy benefits people and the planet. It's led by the European Environmental Bureau (EEB) and ECOS. The EEB is responsible for this study.

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European Climate Foundation

MAVA FONDATION POUR LA NATURE

CONTENTS

BACKGROUND: PRODUCTS THAT DON'T LAST

Europeans feel that their electrical and electronic products do not last as long as they used to. This general perception is backed by recent studies[1-3].

There is, paradoxically, ample evidence of consumer desire for longer-lasting, repairable products. In a public consultation on a circular economy[4], 83.4% responded that 'the EU should set rules to make sure products have a long lifetime'. A survey[5] of over 1000 Austrian residents found that respondents "want products to last considerably longer than they are currently used." And according to a Eurobarometer report on the attitudes of Europeans towards waste management and resource efficiency[6], 77% of EU citizens would rather repair their goods than to buy new ones, but ultimately have to replace or discard them because they are discouraged by the cost of repairs and the level of service provided.

So what's happening? The causes for decreasing lifetimes are complex and varied: Prakash et al[2] cite "deficient mechanical and electronic robustness", "software-induced reasons (including peripheral devices becoming obsolete)", "high cost of repair", and "trends and desire for new functionalities (including socio-demographic factors such as moving to a new apartment)" as the main ones.

In addition, information on durability and repairability is scarce or unreliable at the point of purchasing a product: the EU Energy Label does not yet include information on durability and repairability. And the differences between legal and commercial guarantees or manufacturer's warranties are often confusing for citizens, making it unclear what their rights are when a product is faulty.

Whatever the driver, shorter lifetimes mean that products are being replaced more often than they used to be, with increased impacts on the environment. Repeatedly manufacturing new products to replace old ones consumes resources, creates additional pollution, and is not what consumers desire.

The production of our goods is often overlooked in climate assessments. For example, if emissions linked to manufacturing all imported products – i.e. most of the electricals we buy – were properly accounted for, the EU would not have achieved any reduction in emissions since 1990[7].

1 C. Bakker et al., 'Products that go round: exploring product life extension through design', Journal of Cleaner Production, 69(10-16), April 2014.
2 S. Prakash et al., '*Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen „Obsoleszenz"*', report for Umweltbundesamt, Dessau-Roßlau, Germany, 2016.
3 UN Environment, *The Long View : Exploring product life-time extension*, 2017.
4 European Commission, Sustainable Products in a Circular Economy - Towards an EU Product Policy Framework contributing to the Circular Economy, *(SWD/2019/91final)*, 2019.
5 H. Wieser, N. Tröger and R. Hübner, 'The consumers' desired and expected product lifetimes', *proceedings of the PLATE conference – Nottingham Trent University*, 17-19 June 2015.
7 Buy Clean, *Closing Europe's Carbon Loophole in Climate Policy*, 2018.

ABOUT THIS REPORT

With these observations in mind, EEB set itself to explore several questions:

What is the contribution of the different phases (manufacturing, transport, use and end-of-life) of our electrical and electronic products to global warming?

From a global warming point of view, does it make sense for users to replace their old electricals and electronics, or to keep them running for longer? If the latter, for how long should they be kept?

What would be the environmental benefits - in terms of reduced Global Warming Potential - of repairing and extending the lifetime of our electrical and electronic products?

Four different product groups that are commonly used by Europeans were considered:

- Washing machines
- Notebook computers
- Vacuum cleaners
- Smartphones

We obtained data from existing life-cycle assessment (LCA) literature for these products, which we analysed to try and answer the questions above. At every stage of the process, we used conservative assumptions (e.g. long lifetime of products and high energy efficiency improvement rates) to add layers of caution to our findings. In spite of this, the results are striking.

RESULTS

What is the contribution of the different phases (manufacturing, transport, use and end-of-life) of our electrical and electronic products to global warming? This is an important question that has often been overlooked in EU policy.

The analysis compared the energy needed to produce and distribute new products and dispose of old ones – the so-called non-use phases, distinguishing from when the product is in use or the use phase.

For the four product groups analysed, our analysis shows that the impact of the non-use phases on global warming turned out to be considerable, with some differences:

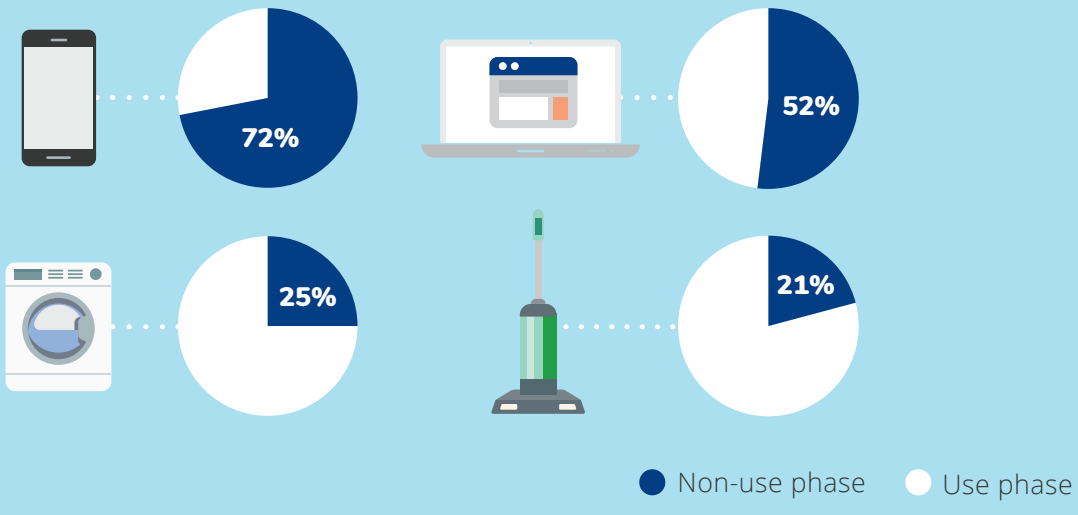
- Between 10% and 31% of the Global Warming Potential (GWP) of vacuum cleaners analysed came from their non-use phases;
- Between 18% and 31% of the GWP of washing machines analysed came from their non-use phases;
- Between 40% and 64% of the GWP of notebook computers analysed came from their non-use phases;
- Between 51% and 92% of the GWP of smartphones analysed came from their non-use phases.

The shares of GWP of the non-use phases are likely to increase in the future, as:

a) Product policies continue to push towards energy efficient products;

b) European electricity continues its trend towards decarbonisation.

The average share of Global Warming Potential (GWP) of products from their use and non-use phases



From a global warming point of view, does it make sense for users to replace old electricals and electronics, or to keep them running for longer? If the latter, for how long should they be kept?

It is often argued that energy efficiency improvements in new products justify "early replacement" of old products, because less energy use will offset the climate impact linked to production.

For all four product groups analysed, we explored the implications of extending their lifetime beyond typical values (11 years for washing machines; 4-5 years for laptops; 5-8 years for vacuum cleaners; and 3 years for smartphones), instead of replacing them by new ones.

Our analysis shows that, under normal circumstances[8], it always makes sense to extend the lifetime of our products beyond their typical lifetimes. From a global warming point of view, washing machines should last for 25 to 40 years to compensate for the greenhouse gas emissions from production, distribution and disposal; vacuum cleaners for 18 to 48 years; notebooks and smartphones should be kept for as long as possible, because not only replacing the old devices consume new resources, but also newer generations are more energy consuming than the previous ones.

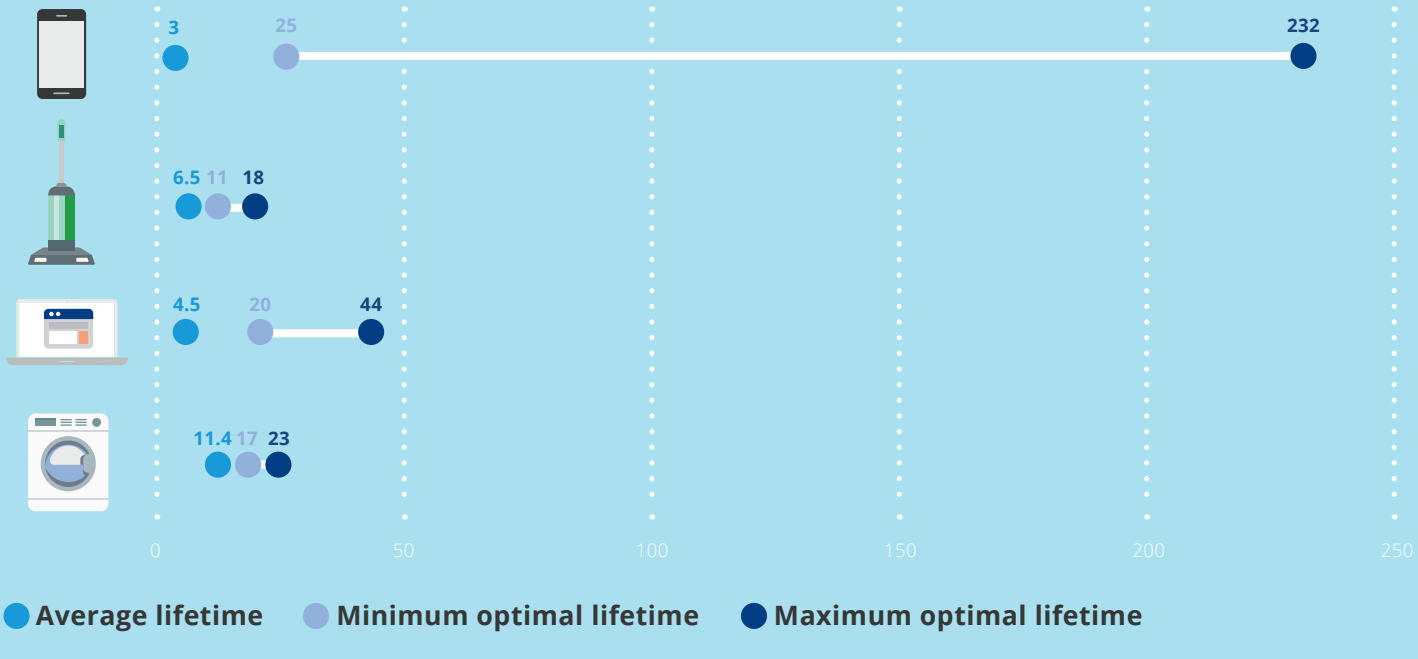
Even when considering extremely unlikely energy efficiency improvement rates of 5% annually, the recommended lifespans are always longer than today's typical ones: washing machines should still be kept for 17 to 23 years; notebook computers for 20 to 44 years; vacuum cleaners for 11 to 18 years; and smartphones for and 25 to 232 years (as seen in the diagram below).

Our results confirm the conclusions of other recent studies. According to a 2018 study by the Öko Institut[9], "with very few exceptions, it is always better for the environment to have faulty home appliances repaired and to keep them in service for as long as possible. This saves the energy and resources that would otherwise be consumed in the manufacturing of new products, which has a considerable impact on the environment."

When factoring in other environmental factors such as ecotoxicity (toxic effects on ecosystems) and abiotic depletion potential (the use of non-renewable resources), the lifespans of these products would likely need to be extended even longer before it makes environmental sense to replace them. This is because such environmental factors are typically more prominent in the non-use phases of products.

HOW LONG SHOULD PRODUCTS LAST FROM A CLIMATE PERSPECTIVE?

Average lifetime vs optimal lifetime to limit Global Warming Potential (years)



8 By 'normal circumstances' it is meant using energy efficiency improvement rates of new products that are in line with Ecodesign and Energy Labelling preparatory studies carried out for the European Commission.

9 Öko-Institut e.V., *Repair or replace? Extending the life span of your home appliances – facts and figures*, Background Paper, 2018.

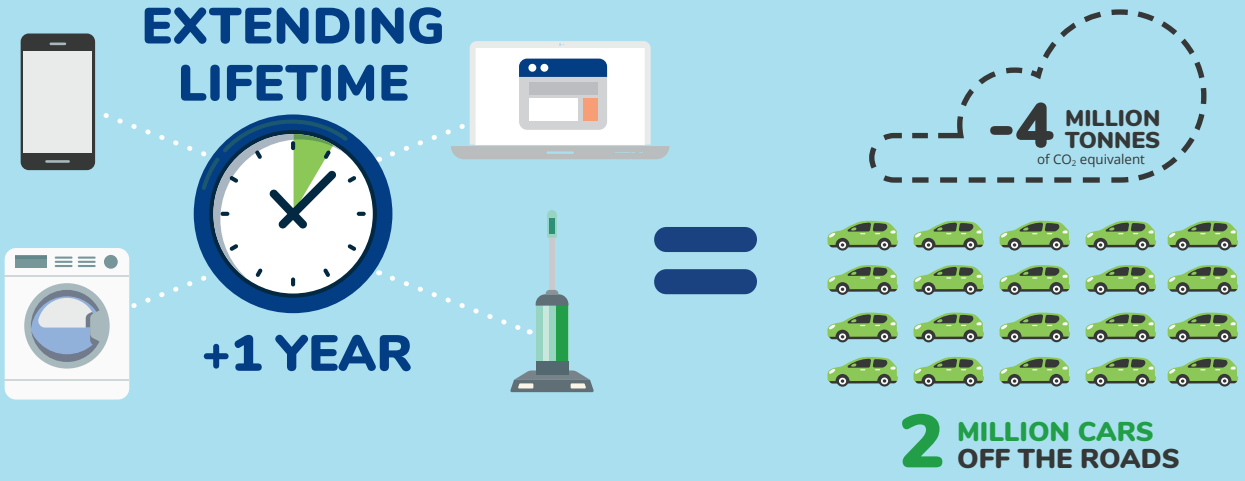
What would be the environmental benefits - in terms of reduced Global Warming Potential (GWP) - of extending the lifetime of our electrical and electronic products?

Using standard[10] hypotheses on sales, stocks and energy efficiency improvement rates , our analysis shows that extending the lifetime of the products analysed would considerably reduce the EU's greenhouse gas emissions:

- A 1-year lifetime extension of all washing machines in the EU would save 0.25 Mt CO2 per year by 2030; for notebooks, the figure is 1.6 Mt CO2; for vacuum cleaners, 0.1 MtCO2; for smartphones, 2.1 MtCO2.
- A lifetime extension of 3 years would save around 0.66 MtCO2 annually by 2030 for washing machines; 3.7 MtCO2 for notebooks; 0.3 MtCO2 for vacuum cleaners; and 4.3 Mt CO2 for smartphones.
- Finally, a 5-year extension would correspond to about 1 MtCO2 annually by 2030 from washing machines; 5 MtCO2 for notebooks; 0.5 MtCO2 for vacuum cleaners; and 5.5 Mt CO2 for smartphones.

Extending the lifetime of all washing machines, notebooks, vacuum cleaners and smartphones in the EU by just one year would save around 4 MtCO2 annually by 2030, the equivalent of taking over 2 million cars off the roads for a year.

The following sections examine the specific results for each of the four product groups.



10 Standard' here means in line with Ecodesign and Energy Labelling preparatory studies carried out for the European Commission.

WASHING MACHINES

About the product

Washing machines are considered 'workhorse' products, typically purchased for prolonged use[11,12] and only discarded when broken[13]. They are subject to extreme vibration and mechanical stress during use, thus appropriate design for strength and durability are key[14].

In the last decades, washing machines have achieved extraordinary reductions in energy and water consumption[15], thus shrinking the relative environmental impacts of the use phase of washing machines. But these improvements are becoming smaller now, which means that a renewed focus on other phases of the product (manufacturing, transportation and end-of-life) should now drive the reduction of the environmental impacts of washing machines.

Embedded emissions

Indeed, the manufacturing, transportation and end-of-life phases of washing machines consume energy and other resources, which contribute to global warming. Our analysis of existing literature[16-18] shows that these "non-use phases" account for between 18% to 31% of the total Global Warming Potential (GWP) of washing machines, for an estimated lifespan of 11.4 years. If this lifespan were to be increased, then the relative share of GWP from non-use phases would decrease, as the non-use phase impact would be spread over a longer lifetime.

Other studies even estimate that the contribution of manufacturing to the overall greenhouse gas emissions of washing machines amount to 25–50%[19].

11 WRAP, *Electrical and electronic product design: product lifetime*, 2013.
12 J. Cox et al., 'Consumer understanding of product lifetimes', Resources, Conservation and Recycling, 79(21-29), 2013.
13 WRAP, *Switched on to Value: Powering Business Change*, 2017.
14 WRAP, *Environmental life cycle assessment (LCA) study of replacement and refurbishment options for domestic washing machines*, 2010.
15 R. Stamminger, A. Barth, and S. Dörr. 'Old Washing Machines Wash Less Efficiently and Consume More Resources', *HuW. Hauswirtschaft und Wissenschaft*, 3(124-131), 2005.
16 Öko-Institut e.V., *Eco-Efficiency Analysis of Washing machines*, 2005.
17 BIO Intelligence Service, *Material-efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products (MEErP). Part 2 – Test Reports TV and Washing Machine*, prepared for: European Commission - DG Enterprise and Industry, 2013.
18 F. Ardente and F. Mathieux, 'Environmental assessment of the durability of energy-using products: method and application', Journal of Cleaner Production, 74(62-73), 2014.
19 Öko-Institut e.V., *Repair or replace? Extending the life-span of your home appliances – FAQs and helpful hints*, 2018.

Replace or repair?

Our analysis shows that it makes sense, from a global warming point of view, to extend the lifetime of washing machines beyond their typical lifetime. Assuming an annual energy efficiency improvement rate of 1.7% of new machines, washing machines should be kept for 25 to 40 years to compensate for the greenhouse gas emissions from production, distribution and disposal. Even when considering extremely optimistic annual improvements of 5% in the efficiency of new machines, the existing ones should still be kept for 17 to 23 years.

Recent studies confirm these conclusions. Öko-Institut[20] show that the ecological payback time (i.e. the time period until an appliance compensates for the environmental cost of its own manufacture and begins to make a positive contribution to the environment) for the replacement of a washing machine that was manufactured in 2000 and is still in good working order is around 40 years in terms of its global warming potential (GWP) – much longer than the expected lifetime of a modern washing machine. Another Öko-Institut[21] study found that, even assuming that a more durable washing machine would be more resource-intensive to manufacture than a model with a shorter lifespan, the more durable machine produced almost 1,100 kg less greenhouse gas emissions over a 20-year period.

Stiftung Warentest, a German consumer organisation that regularly tests washing machines, puts it very clearly: "A consumer who buys a new washing machine whenever their old one develops a fault leaves a much larger environmental footprint than a consumer who has their current model repaired."[23]

Extrapolating to the whole economy

Based on raw data from the preparatory study on washing machines[24], we assessed the environmental impacts from lifetime extension of all existing washing machines in the EU.

Our analysis shows that a 1-year lifetime extension of all washing machines in the EU would save 0.25 Mt CO2 per year by 2030, the equivalent of taking 130,000 cars off the roads. A lifetime extension of 3 years would save around 0.66 MtCO2. And a 5-year extension would correspond to about 1 MtCO2.

Other benefits

Extending the lifespan of washing machines is also likely to be beneficial from an economic perspective. Although the typical costs of repairing a washing machine are quite high, according to Stiftung Warentest, repair is still more economical over the long term than buying a new one[25]. Öko-Institut[26] estimates that buying a new machine every time a budget model develops a fault is 13 per cent more expensive than buying one durable washing machine.

20 Öko-Institut e.V., *Eco-Efficiency Analysis of Washing machines*, op. cit.
21 S. Prakash et al., *'Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen „Obsoleszenz"*, op. cit.
22 Öko-Institut e.V., *Repair or replace? Extending the life-span of your home appliances* – FAQs and helpful hints, op. cit.
23 European Commission's Joint Research Centre, *Ecodesign and Energy Label for Household Washing machines and washer dryers, preparatory Study* - Final Review, 2017.
24 Öko-Institut e.V., *Repair or replace? Extending the life-span of your home appliances – FAQs and helpful hints*, op. cit.
25 S. Prakash et al., *'Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen „Obsoleszenz"*, op. cit.

WASHING MACHINES: SUMMARY

Considering both the use and non-use phases, washing machines have the largest climate impact of the products analysed in this study.

Annual climate impact of EU stock (use and non-use phases):

17.62 MILLION TONNES
of CO_2 equivalent

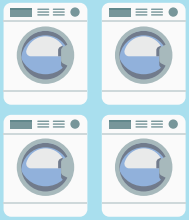
Manufacturing, distribution and disposal account for about

25%

of a washing machine's total climate impact

Expected lifetime[26]:
11.5 YEARS

Annual sales[26]:
13,518,000 units



Total stock in the EU[26]:
202,000,000 units

Extending the lifetime of all washing machines in the EU by

1 YEAR

would save 0.25 Mt CO_2 per year by 2030, the equivalent of taking 130,000 cars off the roads

3 YEARS

would save around 0.66 Mt CO_2

5 YEARS

would correspond to about 1 Mt CO_2

26 European Commission's Joint Research Centre, *Ecodesign and Energy Label for Household Washing machines and washer dryers*, op. cit.

NOTEBOOK COMPUTERS

About the product

Notebook computers are considered part of "fashion electronics", or "up-to-date" products. People replace their notebooks before they break, not only to keep up with the latest technology, but also because poor performance leads users towards hardware upgrades[27]. Declining performance of a notebook may be driven by different factors such as bloatware, adware, software updates, excessively demanding programmes running simultaneously from start-up and poor maintenance overall. All of this, combined with the falling prices for new units, is causing the actual lifetime of notebooks to become ever shorter[28].

Embedded emissions

In addition to the use of the notebook, its manufacturing, transportation and end-of-life phases also consume energy and other resources, which contribute to global warming. Our analysis of existing literature[29-32] shows that these "non-use phases" account for between 40% to 64% of the total Global Warming Potential (GWP) of notebooks, for estimated lifespans of 4 to 5 years. If this lifespan were to be increased, then the relative share of GWP from non-use phases would decrease, as the non-use phase impact would be spread over a longer lifetime.

Other studies even estimate that the contribution of manufacturing to the overall greenhouse gas emissions of a notebook amount to 57–93%[33].

27 J. Cox et al., 'Consumer understanding of product lifetimes', op. cit.
28 UN Environment, op. cit.
29 S. O'Connell and M. Stutz, Product carbon footprint (PCF) assessment of Dell laptop - Results and recommendations, proceedings of the 2010 IEEE International Symposium on Sustainable Systems and Technology, 17-19 May 2010.
30 European Commission Joint Research Centre, *Analysis of material efficiency aspects of personal computers product group*, 2017.
31 B. Kasulaitis et al., 'Evolving materials, attributes, and functionality in consumer electronics: Case study of laptop computers', *Resources, Conservation and Recycling*, 100(1-10), 2015.
32 A. Andrae and O. Andersen, 'Life cycle assessments of consumer electronics – are they consistent?', *International Journal of Life Cycle Assessment*, 15/8(827-836), 2010.
33 Prakash et al., *Timely replacement of a notebook under consideration of environmental aspects, Dessau-Roßlau*, report for Umweltbundesamt, Dessau-Roßlau, Germany, 2011.

Replace or repair?

Our analysis shows that it never makes sense, from a global warming point of view, to replace a notebook. This is because the market of notebooks is actually moving towards products with higher processing capacity, and therefore higher energy consumption . Replacing a notebook therefore means that both its use and its non-use phases create additional global warming.

Even if this trend were to be turned around, and using a very optimistic efficiency improvement rate of 5% per year of new notebooks, the existing ones should still be kept for 20 to 44 years.

Recent studies confirm these conclusions. Prakash et al. say: "Moreover, the environmental impacts of the production phase of a notebook are so high, that they cannot be compensated in realistic time periods by energy efficiency gains in the use phase. In case of a 10% increase in the energy efficiency of a new notebook as compared to the older one, replacement of the older notebook can only be justified after 33 to 89 years, if environmental concerns are considered."[34]

Extrapolating to the whole economy

Based on raw data from the Ecodesign preparatory study on notebooks[35], we assessed the environmental impacts from lifetime extension of all notebooks in the EU beyond the typical 5-year lifespan.

Our analysis shows that a 1-year lifetime extension of all notebooks in the EU would save 1.6 Mt CO2 per year by 2030, the equivalent of taking 870,000 cars off the roads. A lifetime extension of 3 years would save around 3.7 MtCO2. And a 5-year extension would correspond to about 5 MtCO2.

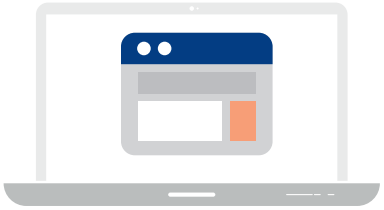
Other benefits

As notebooks are typically manufactured outside the EU, extending their lifespan via repair would support job creation in the EU. Public policy should focus on encouraging the manufacturing of repairable and upgradeable notebooks that can in particular adapt to changes in software. Regulators should also work to limit the prevalence of software which hamper performance, including bloatware, adware and non-essential updates

34 Prakash et al., *Timely replacement of a notebook under consideration of environmental aspects*, op. cit.
35 Viegand Maagøe and VITO, *Preparatory study on the Review of Regulation 617/2013 (Lot 3) Computers and Computer Servers*, prepared for: European Commission, DG Energy, 2017.

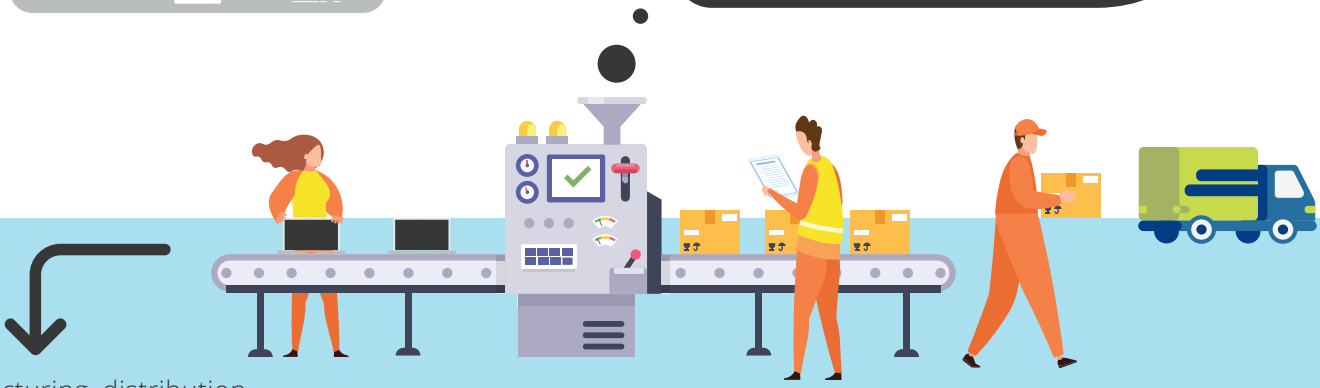
NOTEBOOK COMPUTERS: SUMMARY

The energy and resource intensive production of integrated components such as motherboards means the largest share of a notebook's global warming potential is linked to its non-use phases.



Annual climate impact of EU stock (use and non-use phases):

12.82 MILLION TONNES of CO_2 equivalent



Manufacturing, distribution and disposal account for about

52%

of a notebook's total climate impact

Expected lifetime[36]:
4.5 YEARS

Annual sales[36]:
27,602,000 units

Total stock in the EU[36]:
151,085,000 units

Extending the lifetime of all notebooks in the EU by

1 YEAR

would save 1.6 Mt CO_2 per year by 2030, the equivalent of taking 870,000 cars off the roads

3 YEARS

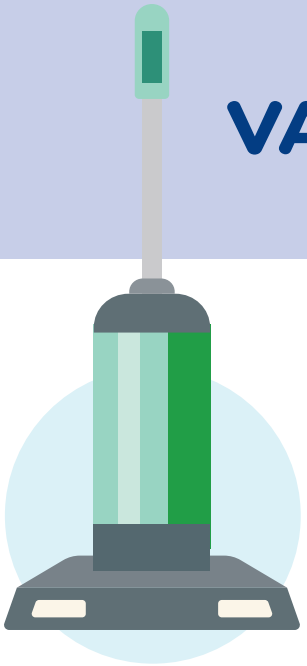
would save around 3.7 Mt CO_2

5 YEARS

would correspond to about 5 Mt CO_2

36 Prakash et al., Timely replacement of a notebook under consideration of environmental aspects, op. cit.

VACUUM CLEANERS



About the product

For reasons of availability of historical data, we focused on domestic vacuum cleaners which can be plugged via a cord. What follows is therefore a conservative exercise, as cordless vacuum cleaners and robots are steadily replacing "traditional" vacuum cleaners in the EU market, albeit with shorter lifetime -because of their dependence on a battery-, and with considerably higher energy consumption[37].

Before Ecodesign requirements were set for vacuum cleaners, the power rating had increased markedly, with consumers persuaded that a powerful cleaner would perform better. However, this higher power did not lead to any noticeable improvements in the cleaning performance[38]. The 2013 Ecodesign requirements on vacuum cleaners curbed this energy trend, and also set durability requirements on their hoses and motors.

Embedded emissions

In addition to the use of the vacuum cleaner, its manufacturing, transportation and end-of-life phases also consume energy and other resources, which contribute to global warming. Our analysis of existing literature[37, 39, 40] shows that these "non-use phases" account for between 10% to 31% of the total Global Warming Potential (GWP) of vacuum cleaners, for estimated life spans of 5 to 8 years. If this lifespan were to be increased, then the relative share of GWP from non-use phases would decrease, as the non-use phase impact would be spread over a longer lifetime.

Replace or repair?

Our analysis shows that it generally makes sense to extend the lifetime of vacuum cleaners beyond its typical lifetime. Using an annual energy efficiency improvement rate of 1.1%[41], our analysis shows that, from a GWP point of view only, vacuum cleaners should be kept for 18 to 48 years to compensate for the greenhouse gas emissionsfrom production, distribution and disposal. Even when considering extremely optimistic annual improvements of 5% in the efficiency of the sold cleaners, the existing ones should still be kept 11 to 18 years.

Extrapolating to the whole economy

Based on raw data from the preparatory study on vacuum cleaners[37], we assessed the environmental impacts from lifetime extension of all vacuum cleaners in the EU beyond the typical 8-year lifespan. This 8-year lifespan is however a conservative hypothesis, as: a) recent studies[42,43] show that 5 years might be more realistic; and b) there is a growing market for robot and cordless vacuum cleaners, which have shorter lifespans but have not been modelled here.

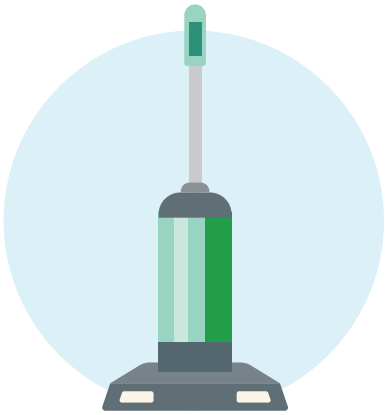
Even under such a conservative hypothesis, our analysis shows that a 1-year lifetime extension of all vacuum cleaners in the EU would save 0.1 MtCO2 per year by 2030, the equivalent of taking 50,000 cars off the roads. A lifetime extension of 3 years would save around 0.3 MtCO2. And a 5-year extension would correspond to about 0.5 MtCO2.

These figures will increase if robots and cordless vacuum cleaners continue to represent a growing share of the market. These products have shorter lifetimes, and include batteries and more complicated components so they are likely to have higher non-use phase impacts.

37 Viegand Maagøe and VHK, *Review Study on Vacuum Cleaners. Draft Final Report*, prepared for: European Commission, DG Energy, 2018.
38 AEA, *Work on Preparatory Studies for Eco-Design Requirements of EuPs (II). Lot 17 Vacuum Cleaners. Final Report*, prepared for European Commission, DG TREN, 2009.
39 A. Gallego-Schmid et al., 'Life cycle environmental impacts of vacuum cleaners and the effects of European regulation', *Science of The Total Environment*, 559(192-203), 2016.
40 V. Pérez-Belis et al., 'Environmental performance of alternative end-of-life scenarios for electrical and electronic equipment: A case study for vacuum cleaners', *Journal of Cleaner Production*, 159(158-170), 2017.
41 Viegand Maagøe and VHK, *Review Study on Vacuum Cleaners. Draft Final Report*, op. cit.
42 Öko-Institut e.V., *Repair or replace? Extending the life-span of your home appliances – FAQs and helpful hints*, op. cit.
43 WRAP, Switched on to Value: Powering Business Change, op. cit.

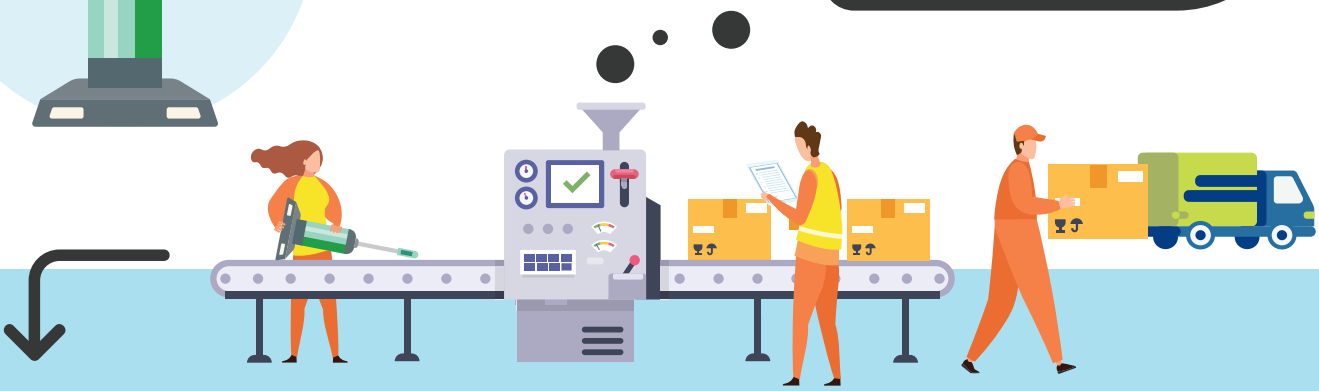
VACUUM CLEANERS: SUMMARY

The largest climate impact of vacuum cleaners comes from their use phase. Nonetheless, they are replaced before they should, mostly due to failures or drastic loss of performances as well as the introduction of fragile robots and cordless units.



Annual climate impact of EU stock (use and non-use phases):

4.2 MILLION TONNES of CO_2 equivalent



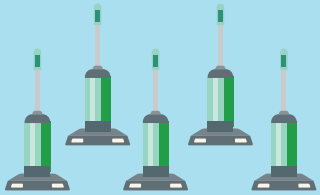
Manufacturing, distribution and disposal account for about

21%

of a vacuum cleaner's total climate impact

Expected lifetime[44]:
6.5 YEARS

Annual sales[44]:
37,300,000 units



Total stock in the EU[44]:
277,210,000 units

Extending the lifetime of all vacuum cleaners in the EU by

1 YEAR

would save 0.1 Mt CO_2 per year by 2030, the equivalent of taking 50,000 cars off the roads

3 YEARS

would save around 0.3 Mt CO_2

5 YEARS

would correspond to about 0.5 Mt CO_2

44 Viegand Maagøe and VHK, Review Study on Vacuum Cleaners. Draft Final Report, op. cit.

SMARTPHONES

About the product

Smartphones are considered part of "fashion electronics", or "up-to-date" products. This means that they are often replaced before they break, not just to keep up with the latest technology, but also because users are offered regular upgrades within their contracts, or feel locked into frequent hardware upgrades[45] because of new incompatible technologies and the processing demands of the latest applications. All of this is causing the actual lifetime of smartphones to become ever shorter.

Embedded emissions

In addition to the use of a smartphone, its manufacturing, transportation and end-of-life phases also consume energy and other resources, which contribute to global warming. Our analysis of existing literature[46-49] shows that these "non-use phases" account for between 51% to 92% of the total Global Warming Potential (GWP) of smartphones, for an estimated lifespan of 3 years. If this lifespan were to be increased, then the relative share of GWP from non-use phases would decrease, as the non-use phase impact would be spread over a longer lifetime.

This confirms findings from other studies. For example, Suckling & Lee[48] state: "the dominance of the extraction and manufacture phase is clear, being 74.1% of the total impact."

Replace or repair?

As a starting point and given the lack of data on historic energy consumption of smartphones, we assumed that the trend towards higher processing capacity results, as it does for other electronic products, in higher energy consumption. Under that hypothesis, our analysis shows that it never makes sense, from a global warming point of view, to replace a smartphone. Indeed, replacing a smartphone under such circumstances would mean that both its use and its non-use phases create additional global warming.

Even if this trend were to be turned around, and using a very optimistic efficiency improvement rate of 5% per year of new smartphones, the amortisation period would range from 25 to 232 years, which is evidently longer than the typical lifetime of a smartphone. In other words, from a global warming perspective our phones should last at least 20 years longer than they currently do. This would require a significant change in how phones are designed and marketed.

Extrapolating to the whole economy

Based on similar energy efficiency improvement rates as for notebooks, we assessed the environmental impacts from lifetime extension of all smartphones in the EU beyond their typical 3-year lifespan.

Our analysis shows that a 1-year lifetime extension of all smartphones in the EU would save 2.1 Mt CO2 per year by 2030, the equivalent of taking over a million cars off the roads. A lifetime extension of 3 years would save around 4.3 MtCO2. And a 5-year extension would correspond to about 5.5 MtCO2.

Other benefits

Despite being ubiquitous, smartphones are currently not regulated under EU product policy. EU product policy should urgently focus on encouraging the manufacturing of repairable and upgradeable smartphones that can in particular adapt to changes in software. This would not only have environmental benefits, but also support job creation in the EU.

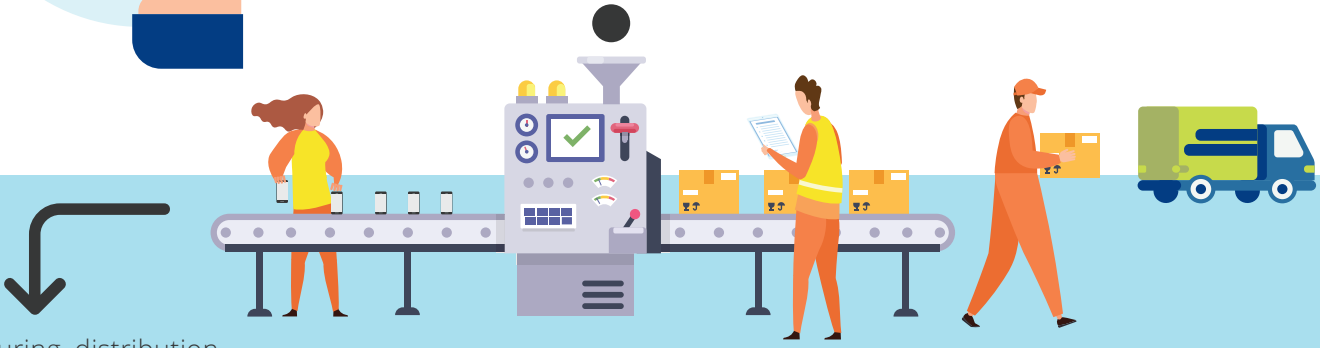
45 J. Cox et al., 'Consumer understanding of product lifetimes', op. cit.
46 S. Frey, D. Harrison, and E. Billet, 'Ecological footprint analysis applied to mobile phones', *Journal of Industrial Ecology*, 10(1-2), 2008.
47 E. Huang and K. Truong, *Breaking the disposable technology paradigm: opportunities for sustainable interaction design for mobile phones*, Florence, Italy: CHI Proceedings - Green day, 5-10 April 2008.
48 J. Suckling and J. Lee, 'Redefining scope: the true environmental impact of smartphones?', *The International Journal of Life Cycle Assessment*, 20/8(1181-1196).
49 A. Andrae and M. Vaija, 'To Which Degree Does Sector Specific Standardization Make Life Cycle Assessments Comparable?—The Case of Global Warming Potential of Smartphones', *Challenges*, 5(409-429), 2014.

SMARTPHONES: SUMMARY

Manufacturing Europe's smartphones has the largest climate impact of the products analysed in this study. This is because the production of their components, containing rare and critical materials, is material and energy intensive.

Annual climate impact of EU stock (use and non-use phases):

14.12 MILLION TONNES of CO_2 equivalent



Manufacturing, distribution and disposal account for about

72%

of a smartphone's total climate impact

Expected lifetime[50]:
3 YEARS

Annual sales[51]:
210,800,000 units

Total stock in the EU[51]:
632,400,000 units

Extending the lifetime of all smartphones in the EU by

1 YEAR → **3 YEARS** → **5 YEARS**

would save 2.1 Mt CO_2 per year by 2030, the equivalent of taking over **a million cars off the roads**

would save around 4.3 Mt CO_2

would correspond to about 5.5 Mt CO_2

50 J. Suckling and J. Lee, op. cit.
51 European Commission Joint Research Centre, *Guidance for the Assessment of Material Efficiency: Application to smartphones – version 2*, 2019.

RECOMMENDATIONS

Even under conservative assumptions, our results debunk the myth of early replacement, i.e. that products should be replaced early in order to benefit from the reduced energy consumption of new, more energy-efficient products. Early replacement may only make sense in some exceptional cases, e.g. for earlier models of vacuum cleaners with a very high energy consumption[52].

If instead of being replaced too early, product lifetimes are extended, the rate at which we use up natural resources and produce waste is considerably reduced, and the economic value embedded in our products preserved. Extending the lifetime of products can be achieved by using products for a longer period of time; by extending their use through design, maintenance and upgrades; and by recovering broken products through repair, refurbishment and remanufacturing.

All market actors can contribute to ensure that our products last longer. Here is how:

Users

- When purchasing a new appliance, whenever possible choose high-quality products. They generally have a long lifespan and therefore offer environmental benefits and, in many cases, better value for money. You can also follow independent advice on products that are particularly well rated in terms of durability and repairability[53].
- Follow advice from the manufacturer's instructions and from consumer organisations on how to make your product last longer. This will avoid unnecessary, sometimes costly, repairs.
- Faced with a faulty product, troubleshoot using the manual (if there is one available) and maybe you can repair the product yourself. Some repairs are very simple and can be repaired by someone with no technical knowledge. You can also seek advice online or at your local repair cafe.
- For technical repairs, get a quote from professional repairer (at least to see what the price will be compared to buying new).

Manufacturers

- Design your products for durability, as this is what consumers want. This is about the strength of the product, but also modularity, repairability and upgradability.

  Some products have an actual lifetime which is roughly equivalent to their technical lifetime, i.e. they are only replaced once they stop working. For these products the focus should be on design options to increase the technical lifetime (e.g. designing for disassembly, availability of spare parts, and providing access to repair manuals).

  For products which are used less than their technical lifetime allows (e.g. "lifestyle" products), the focus of the improvement options should be on on design options which might promote a longer use (e.g. interchangeable casings, upgradability of both hardware and software, replaceable batteries and screens)[54].
- Provide a long after-sales support to help users with repairs/upgrades, as this would also help increase lifespan of products.
- Develop business models such as affordable leasing or product-as-a-service, which provide users with access to the product rather than ownership. These business models reduce the number of products by increasing their utilisation rates, and thus reduce the toll on the environment.

52 For example, users who bought their vacuum cleaners before the 2013 power limit of 1600W, and who use it regularly. This is because the energy efficiency improvements of vacuum cleaners have been particularly rapid in the last few years thanks to the 2013 Ecodesign and energy Labelling regulations.
53 e.g. Ifixit's teardowns. The European Commission's Joint Research Centre (JRC) is also working on a repairability score system.
54 BIO Intelligence Service, *Material-efficiency Ecodesign Report and to the Methodology for the Ecodesign of Energy-related Products (MEErP). Part 2 – Enhancing MEErP for Ecodesign*, prepared for: European Commission - DG Enterprise and Industry, 2013.

Public Authorities

Both European and national authorities should prioritise lifetime extension and repair of electrical and electronic products in European product policies. As we have seen, the environmental benefits are large, and expected to increase in the future. This would not only help Europe deliver on its circular economy and climate change objectives, but would also support employment, as a boosted repair sector would create jobs that cannot be easily delocalised.

Measures to increase the durability of products have already been introduced, albeit not in a systematic way. Below are some policy measures that European and national authorities can consider to continue advancing the path already started under European Union (EU) product policy :

- Systematically considering the greenhouse gas (GHG) emission reduction potential linked to the non-use phases of products, in addition to that of the use phase (i.e. in MeerP[55] and Ecodesign impact accounting).
- Setting minimum requirements on design for disassembly and public access to spare parts and repair manuals, for all electrical and electronic products.
- Setting of a minimum guaranteed lifetime, for products or their key components.
- Including lifetime and repair information on the EU energy label.
- Display of the free extension of current legal manufacturers' guarantees of 2 years.
- Implementation of an EU Extended Producer Responsibility (EPR), whereby the manufacturer would be responsible for the entire life-cycle of products.
- Setting of a minimum availability time for spare parts and a maximum delivery time.
- Setting a minimum compatibility period of new software with existing hardware.
- Establishing the standardisation of certain components to reduce the diversity of spare parts and simplify repair (e.g. chargers and connectors).
- Establishing incentives to create a vibrant market for repair, which would reduce costs and encourage users to repair (e.g. a reduced VAT on repair services, tax reduction for people have repaired products, create a national register of repairers independent from manufacturers accreditation schemes.

55 Methodology for the Ecodesign of Energy-related Products

FURTHER READING

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