Effects of European regulation and eco-design analysis on the environmental impacts from domestic appliances

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TITLE: EFFECTS OF EUROPEAN REGULATION AND ECO-DESIGN ANALYSIS ON ENVIRONMENTAL IMPACTS FROM DOMESTIC APPLIANCES: THE CASE OF VACUUM CLEANERS
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ABSTRACT: Introduction and methods The number of vacuum cleaners (VCs) currently in use in the European Union (EU) is equivalent to 213.8 million. Overall, they consume 400 TWh of electricity per year, equivalent to the annual electricity consumption by 9.8 million households. Additionally, as the market continues to grow and product innovation cycles become shorter, the replacement of VCs accelerates. As a result, the amount of VCs waste is growing. Both, the EU eco-design regulation on energy-related products (ErP) and the revised EU directive on waste electrical and electronic equipment (WEEE), are aimed to improve the energy efficiency and minimise waste generation from these products. However, the recently published EU circular economy package stresses that the eco-design of ErP should not only target energy efficiency but to integrate also the consideration of circular economy aspects, such as durability, reparability, upgradability or closed-loop recyclability. The results from a life cycle assessment (LCA) show how much the implementation of these EU regulations by 2020 would help reducing the environmental impacts associated with VCs. Also, a product eco-design analysis shows the hotspots for improvement in order to build circular business models for these products. **Results and discussion** Despite an expected 8% increase in the number of VCs by 2020, all the impacts categories considered would be reduced by 35-48%, except abiotic depletion of elements, with an increase by 4%. These improvements are mainly due to the implementation of the eco-design regulation and the assumed decarbonisation of the electricity. The environmental savings related to the implementation of the WEEE directive will be smaller. Additionally, the WEEE directive will not contribute to improve resource productivity if business-as-usual is applied in waste management. This regulation establishes that least 50% of the weight of the products should be recycled. However, open-loop recycling (product downcycling) would contribute to material losses. The eco-design analysis of a VC representative of the EU market demonstrated only 20% in the effectiveness of disassembly due to the complexity of the product architecture. Design for simplicity and modularity, parts standardisation and labelling, product light-weighting and material substitution were identified as key strategies to improve the “circularity” of the products, save material resources and reduce environmental impacts over time.