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Value retentions options in circular economy: Issues and challenges of LED lamp preprocessing

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Circular economy is gaining increasing attention for its renewed attention of increasing material circularity through proposing a set of value retentions options and organizing business, institutions and policies accordingly to prepare a congenial atmosphere for their implementation. LED lamp recycling is becoming increasingly important with increasing market share and its precious metal content. Instead of current shredding approach, this study applied higher value retention options such as testing for functionality of the bulb at the product level, manually disassemble to reuse fraction at the component level, automatic disassembly for the industrial scale reuse. This study finds that effort for implementing higher vale retention options (such as reuse) requires new form of secondary business, wider network formation of recycler chains and favorable policies. This study shows that, about 50% lamp waste stream is still functioning and economically attractive if they are remarketed, but the demand-pull business organization seems to be missing. For manual disassembly, the output fractions are clean but due to high labor cost, it is not economically feasible. On the other hand, automotive disassembly does not produce cleaner fractions due to wider design variability. Thus, this study suggests that to gradually shift to shredding focused resources recovery to reuse focused resources circularity, a comprehensive framework that simultaneously encourage building secondary market, formulating favorable reuse policies and forming network of manufactures, recyclers and companies, is required. This study followed circular economy strategies, applied to LED lamp recycling and at the same time, contributed to it, by informing challenges and possible solutions.

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