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Richter, Jessika Luth

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LUND UNIVERSITY

PO Box 117  
221 00 Lund  
+46 46-222 00 00



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# WEEE with Value

## Experience from Lighting Products

Jessika Luth Richter



THE INTERNATIONAL INSTITUTE FOR  
INDUSTRIAL ENVIRONMENTAL ECONOMICS

### Highlights

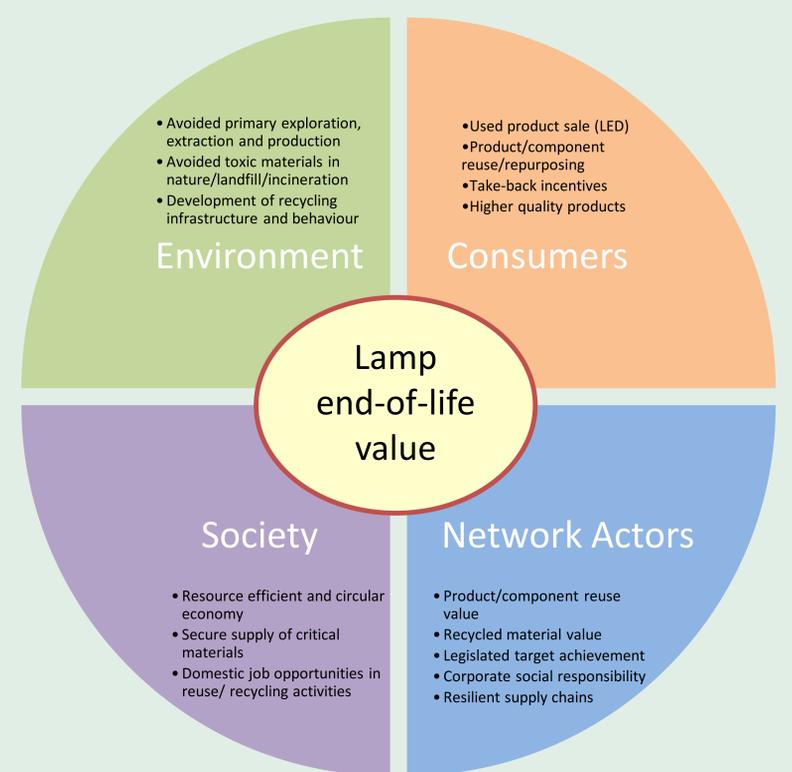
- WEEE with value has traditionally been considered by simple cost - benefit analysis or models, while the reality is more complex.
- Lighting products demonstrate that value can also arise from more holistic considerations of value, and is influenced by multiple stakeholders, time considerations, and market conditions.
- Mapping value can help incentivise and plan for value in rapidly changing products like lighting and other EEE.

### Introduction

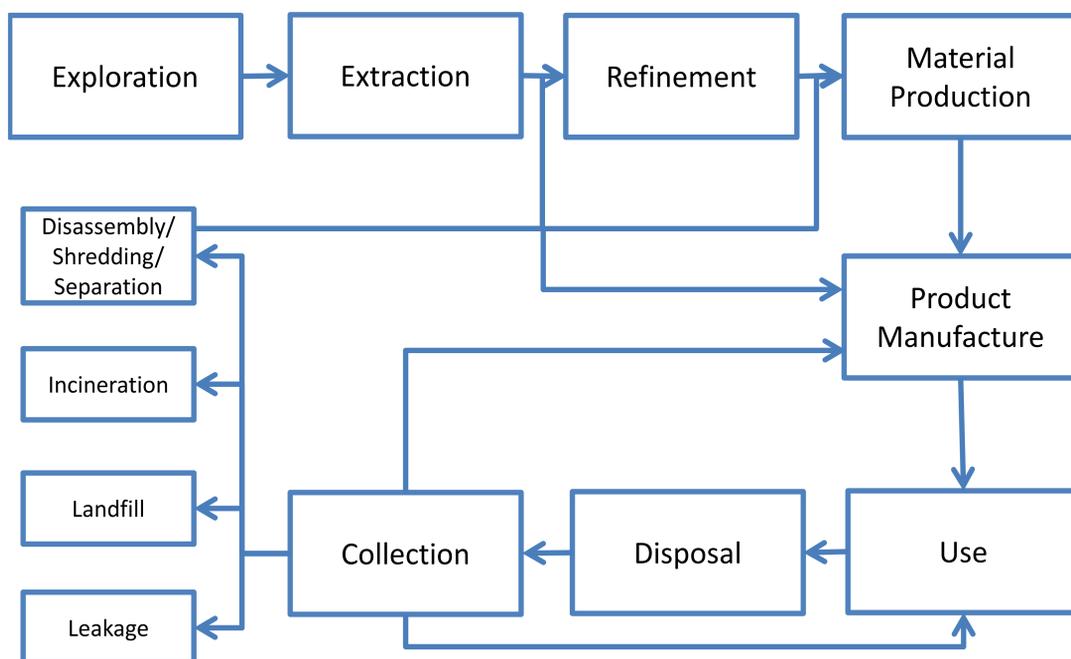
An extended producer responsibility (EPR) programme entails the establishment of collection schemes designated for targeted products like waste electrical and electronic products (WEEE). There is little debate about the environmental benefits of recycling rather than landfilling of WEEE.

Recycling can recover material of value that exceeds the cost of the collection and recycling processes - often perceived as "valuable WEEE" (e.g. many types of phones and laptops). This has raised challenges for EPR programmes under the WEEE Directive 2012/19/EU that have been designed assuming waste without value.

While recycled materials with traditional value need to be considered carefully, waste products currently without value, e.g. lamps, should also be examined with more holistic value considerations, including changing market conditions, rapidly developing technology, externalities, as well as different stakeholders.



Simplified value mapping for end-of-life lamps



Product value chain with option for end-of-life management

### Value in Lamps

The WEEE Directive covers all modern energy efficient lamps including fluorescent lamps and light emitting diodes (LEDs). Fluorescent, or gas discharge, lamps are also currently addressed as a sub-category and given special mention (e.g. Art. 5) due to mercury. The lamp recycling process yields mostly glass fractions, the value of which is highly dependent on contextual and geographic factors. There are also metal, plastic, mercury and rare earth element (REE) powder fractions.

Despite the small amount in each lamp, the EPR systems for collection in the EU and the advanced recycling processes have made lamps one of the few waste products with REE recycling demonstrated on a commercial scale [1-2]. The recent high REE prices and their criticality for EU industries led to increased interest and funding for more research into recycling of REE from lamps, further developing techniques and efficiency. However, technically promising recycling initiatives now face challenges to be economically viable since the high REE prices have since fallen.

Lamps represent a classic product group for EPR policy as it was originally designed, i.e. they represent a net cost for treatment, and recycling the waste products clearly avoids environmental harm. However, even with the WEEE Directive, the average collection rate in the EU is estimated below 30% [3]. Collection rates in the EU are far from uniform, with some countries like Sweden collecting waste lamps at high rates [4]. Improvement in collection is important for lamps where collecting (and retaining) critical materials may be a short-term opportunity. In the coming 10 years the waste from fluorescent lamps in the EU is expected to double [3]. After this, the amount of waste fluorescent lamps and the amount of REE available for recycling from lamps will decrease significantly with the rapid market penetration of LEDs.

The rapid shift to solid state lighting technologies also means a shift in the value considerations for waste lighting products. While high recovery of REE could be less viable, the longer life and higher functional value of LEDs enable additional opportunities, including reuse and development of a second-hand market. An opportunity could develop for LED components to be repurposed or used in remanufacturing. The latter may be more likely if lighting products move from product ownership models to a functional ownership (product service) models [4]. The barriers to these development need to be addressed as the value of used and end-of-life LEDs is influenced by product design and business considerations taking place now.

### This Study

This study reviewed the topic of valuable WEEE and EPR, with an interdisciplinary perspective drawing upon academic literature from diverse disciplines. It also presents a new case of lighting products in which EPR and other policies can be a significant enabler of value recovery. The case research is based on review of academic and grey literature, EPR performance data in Eurostat and semi-structured interviews with key actors including producer responsibility organisations (PROs), recyclers, retailers, and municipal waste management organisations. A review of WEEE and EPR academic and grey literature revealed many of the observed conditions in which value has arisen in WEEE. The case of lighting products revealed additional conditions in which value can arise and the complex and dynamic nature of value that is influenced by individual, company, and societal level value considerations, policies on different levels, global market conditions and technological developments.

### Implications for Policy

#### Dynamic Value, Certain Policy

The issue of competition between producers and other actors for valuable WEEE has resulted in policy suggestions that producers should only pay for WEEE where there is a cost [5]. The research highlighted the historical rise and fall of metal prices and other value factors, demonstrating that this value can be dynamic. Designing policy to flexibly accommodate dynamic value (i.e. with a mechanism for triggering responsibility) would also raise issues of regulatory uncertainty. Value could be addressed more directly through the design of targets. The value to the environment as well as overall societal welfare must both be considered carefully.

#### Valuing Reuse and Recycling

There is a role for policy in creating more certainty about the value of used products and recycled materials. Considerations should include:

- EPR legislation including reuse targets
- Improved data provision and reporting for recycling and reuse
- Inclusion of recycling targets for key and critical materials and products
- Developing both the Ecodesign Directive and the WEEE Directive with focus not only on the recyclability of products, but also how recycled fractions or components of old products could be incentivised and preferred for reuse and use in new products

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