Master thesis : Assessment of the data centre equipment circular economy

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ASSESSMENT OF THE DATA CENTRE EQUIPMENT CIRCULAR ECONOMY

ABSTRACT

Key words: *Data Centre, Critical Raw Materials, Waste Electrical and Electronic Equipment, Dismantling, Life Cycle Assessment, Ecodesign.*

Data Centres Industry (DCI) is one of the important pillars of the current technological and economic developments. In 2017, DCs' global traffic data was 11.7 ZB and it is supposed to grow up to 20.6 ZB in 2021, while in 2010 was only 1.1 ZB [1]. In Europe, DCI is concentrated in North-West Europe, where >55% of DCs are located (Dodd et al., 2018, CloudScene, 2018).

DCs are formed by electronic and electrical equipment (EEE), category of products is reported to cause 1 to 4% of environmental impacts in Europe according to Labouze, Monier et Puyou. In this type of equipment, more than fifty different materials can be found per product, including ferrous, non-ferrous metals, precious metals (PM), platinum group metals (PGM), rare earths (REE), plastics or ceramics, where some of them are considered as Critical Raw Materials (CRMs) by the European Commission [5]. The CRMs recycling rates from WEEE is ~1% [6], in consequence there is large room for improvements along the whole life cycle to increase the recovery of these materials.

This assessment aims to study the design and material composition of data centre equipment (servers and network equipment) to analyse their performance in a circular economy and their environmental performance to provide ecodesign recommendations. First, the state of the art presents the current practices, trends and challenges in Data Centre Industry (DCI) to achieve higher circularity. Then, end-of-life servers and switches were dismantled and a motherboard was chemically characterised. A screening Life Cycle Assessment (LCA) including all the life cycle stages except the use phase is carried out to identify the environmental hotspots. Moreover, an economic assessment on a full dismantling business case has been done to assess the feasibility of the introduction of a new stakeholder in charge of fully dismantling and distributing the waste streams to achieve higher material recoveries.

The assessment shows the high need to achieve higher material resources efficiency in DCI to ensure a secure supply chain of materials, especially CRMs. PCBs have been identified as the most environmentally impactful components of DC equipment and the ones with highest economic and environmental benefits if recycled by take-back schemes. There is still large room for improvements in the design of equipment to allow higher material recoveries. Much more collaboration among stakeholders in DCI is needed to ease reuse, refurbishing and recycling of equipment. Given the high complexity of the electronics equipment supply chain, regulatory bodies should be in charge of encouraging best practices and banning actions that avoid higher circularity.