LIFE CYCLE ASSESSMENT OF SHIP RECYCLING: METALS RECOVERY

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In 2010 the International Maritime Organization (IMO) reported that more than 100.000 ships where operating world wide for people and goods transport. (Maritime Knowledge Centre, 2011). This huge number of ships need to be dismantled at the end of their life cycle. Thus, during the last decade, concerns about the environmental costs of ship breaking activity start to develop around science and policy makers, (Hiremath et al., 2015). Ship recycling help in recovering great numbers of materials and valuables, such as, machineries, household accessories, plastic, glass and most of all metals. Ship recycling industry can be considered Sustainable and participant to the circular economy principles, as almost the whole ship products can be reused, recycled and resold, (Sarraf et al., 2010). Although the great economic and environmental benefits originate by ship recycling; barriers still exist within the current system, (Choi et al., 2016). Policies have been promoted by many international authorities, such as the United Nations, to address the issue related to ship breaking, (Chang et al., 2010). In 2009, the Hong Kong Convention (HKC), (IMO, 2013) and in 2013 the European Union, with the "Ship Recycling Regulation" (EU, 2013), regulated the ship recycling, ensuring that ships, during their end of life phase, do not pose any risks to human, and developed authorization of ship recycling facilities and safe and environmentally sound recycling of ship, (Hiremath et al., 2016). The night of the 13 January 2012 the cruise ship Concordia shipwrecked near the Giglio Island in the Mediterranean sea. The Concordia wreck have been processed in accordance with the previously presented policies, and given the size and the uniqueness represents an important case study for many and multidisciplinary studies. Giving the fact that more than 95% of ship weight is represented by steel and metal scrap, (Deshpande et al., 2013), this study evaluates the environmental burdens of the operations for metals recycling with a Life cycle assessment methodology. The assessment is developed as a comparison between conventional metal production and metals recycled from the cruise ship. Five different metal waste flows, are investigated, taking into account all the operations for the dismantling of the materials, their transport to the different recycling facility and the transformation of the metal scraps in recycled metals. The same analysis was done for the traditional metals (Figure 1). Acidification, eutrophication, climate change and energy requirement are the impact categories evaluated. Moreover, an economic analysis of the traditional metals and the recycled metals is carried out. Results show that recycled metals from the wrecked cruise ship have an overall better environmental score than the conventional ones. However, in the light of the results of this study, metal scrap recycling induce significant environmental impacts, especially in the climate change category, where the separation from impurity process results as highly incisive in the generation of green house gasses.

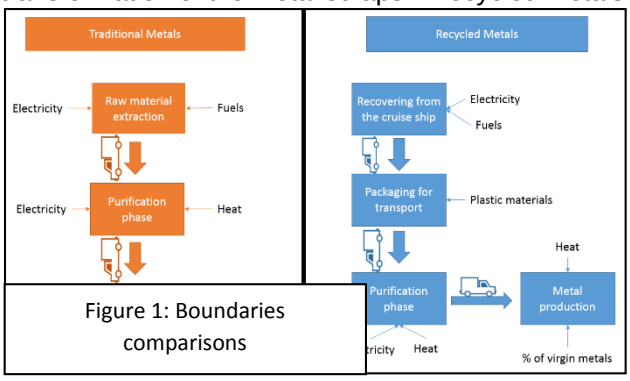

Figure 1: Boundaries comparisons

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