

Introduction Environmental considerations need to be integrated with policy analysis. Previous work on LCA can be a valuable decision support tool, for example in aluminium recycling to identify the environmental burdens and benefits, of altering the raw materials in the recycling process [5]; or for comparing alternative solid state recycling routes with the remelting ones [7]; or for quantifying future emission pathways for the global aluminium cycle [2]. Fossil-fuel-fired or nuclear-centralized steam generators; large-scale and small-scale hydroelectric power; and renewable options, such as geothermal, wind, and solar power, each have a unique set of properties that can significantly influence the results of the life cycle assessment. The energy consumed in any stage in the life cycle of the production chain has a significant effect on the associated inventory of emissions and environmental impacts because of large differences in power generation. Primary aluminium production is one of the most energy intensive materials, requiring on average 66MJ of energy per kg in 2012, of which 80% as electricity in the Hall-Heroult process [8]. The Green House Gas (GHG) emissions associated with the 2007 global aluminium cycle account for 0.45 Gt CO₂ eq., or approximately 1% of the global GHG emissions [9, 2]. Smelting and other primary-production related processes (mining, refining and production of anodes for smelting) together are responsible for over 90% of the total emissions [2]. The most important emission source is indirect emissions (65% of the total), predominately occurring from electricity production, followed by process emissions (18%) and fossil fuels (17%). Thus, indirectly, the overall environmental impact of primary aluminium production, is highly geographically dependent on the energy mix used for power generation. This paper aims to address this research question and provide a more detailed view of the sector's impact by analysing the identified major contributing countries. LCA is widely used in the aluminium industry [1-5] and provides a comprehensive methodology [6]. Different regions/countries use different energy mixes for electricity production. For this reason a detailed comparative LCA study was conducted.