A summary of the methodology for the Mass Flow Modelling conducted for the International Aluminium Institute (IAI)

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1.0 Introduction

On the behalf of the International Aluminium Institute (IAI), Eunomia has built a mass flow model which consists of a mass flow analysis of all the raw material and production stages for aluminium cans sold into Europe. The following provides a summary of the methodological approach taken to build this model, and the sources of data used to populate it.

2.0 Aluminium Can Raw Material Mass Flow

This following summarises the methodology for the mass flow model of aluminium can production in Europe. The countries included in this model, referred to as "Europe", are the 27 European Union Member States, European Free Trade Association member countries and the United Kingdom. The model displays the raw material extraction and production stages of aluminium prior to becoming a can which includes mining bauxite and refining into aluminium oxide (alumina), smelting the aluminium oxide into aluminium ingots and rolling into sheets ready for can making. These processes take place throughout the world and bauxite, aluminium oxide, and finished aluminium are all imported into Europe. For simplicity, other raw materials used in the production of aluminium were not traced.

In addition, based on where the can manufacturing plants are located in Europe, the amount of cans manufactured in each country are estimated. Lastly, the data from each country is aggregated to provide a holistic view of Europe's aluminium can production and the source of the material used in it.

2.1 Aluminium Can Production

Prior to gathering the production data for Europe, each country's capabilities were mapped including mining, refining, smelting and rolling capacity. This was completed by using desk-based research which ensured that each country's capabilities are accurately represented and that the correct production data was gathered. For example, only Greece has bauxite mining capacity in Europe and therefore all other bauxite has to arrive from outside in various forms.

In order to capture each stage of aluminium can production process, trade data was utilised. The data gathered is from 2019 and from Trade Map[1] which is based on UN Comtrade[2] data. The trade data was collected for each country which included looking at specific commodities to track the raw materials used in the aluminium can production value chain. Table 2-1 displays each aluminium can production stage and the corresponding commodity code that was utilised to capture the production activity within the trade data.

Table 2-1: Production Stage and Commodity

Aluminium Can Production Activity	Commodity and Code
Mining	Aluminium Ores and Concentrates (2606)
Refining	Aluminium Oxide (281820)
Smelting	Unwrought Aluminium (7601)
Rolling	Plates, Sheets and Strip, of Aluminium, of a Thickness of >0.2mm (7606)

The imports and exports were gathered for each European country with regard to the country's domestic capacity for each production activity. The imports and exports were displayed by country and the tonnes imported to/exported from the European country. The top five countries that imported to/exported from each European country was used in the model as it captures, at minimum, over 60% of the trade for each European country. Once the data for each European country was gathered, assumptions were used to link each production activity and account for the losses associated with each process.

The assumptions used to link each production activity are displayed in Table 2-2. Both refining and smelting have conversion losses associated with these processes.

Table 2-2: Production Activity Conversion Rates

Aluminium Can Production Activity	Aluminium Can Production Activity Conversion	Conversion Rate
Refining	Bauxite to Alumina	35.1% of Bauxite is converted to Aluminium[3]

[1] https://www.trademap.org/Index.aspx
[2] https://comtrade.un.org/
[3] Calculated by expert. Used data from World Aluminium LCI (https://bauxite.world-aluminium.org/uploads/media/1274452849Global_LCI_Report_03.pdf) – used previously in Eunomia aluminium can mass flow models

Smelting	Alumina to Aluminium	51.9% of Alumina is converted to Aluminium[4]

Comparing the European demand for cans with the overall demand for aluminium, the model shows that 7% of aluminium is converted to cans. This figure is validated based on the data provided in the 2010 U.S. Geological Survey report on global aluminium flows[5]. The report shows that 13.5%, on average, of the aluminium market share in Europe is packaging (predominantly cans). This somewhat close to the calculated value of 7% which does not include exports and is therefore expected to be slightly lower. It is also assumed that there are no losses during the sheet forming and can making process. Whilst in practice there is significant wastage, this is all immediately remelted for use in cans again and therefore there are effectively no losses from the system.

After linking each production activity using the trade data for each European country, the data was then aggregated to present a holistic view of the aluminium can production process in Europe and where the main imports were coming from and which European countries they were going to. The model concludes with total tonnes of cans PoM by taking the difference between the PoM data used in Section 2.1 and the tonnes of cans manufactured in Europe based what the model derived. It was assumed that the difference between the cans manufactured and cans PoM is exported. Therefore, this model ends where the waste management mass flow commences.

2.2 Data Limitations

The UN Comtrade data is not entirely accurate and consistent as there are instances where the data does not display accurate cross-counting between countries (i.e. Germany exports 200 tonnes to France but the data from France shows they imported only 150 tonnes from Germany). Additionally, some of the data from the countries relied on estimates used by Comtrade. However, these inaccuracies are generally small and once aggregated do not greatly affect the output or the conclusions.

Equally, it is impossible to track every movement of raw material around the globe, which is why the focus was put on the main importers of the key materials. The outputs of the model should therefore be viewed as an indication of the overall flows and where they originate from rather than a representation of every movement of raw materials in the aluminium can value chain.

[4] Calculated by expert. Used data from World Aluminium LCI (https://bauxite.world-aluminium.org/uploads/media/1274452849Global_LCI_Report_03.pdf) – used previously in Eunomia aluminium can mass flow models

[5] https://pubs.usgs.gov/of/2010/1256/pdf/ofr2010-1256old..pdf