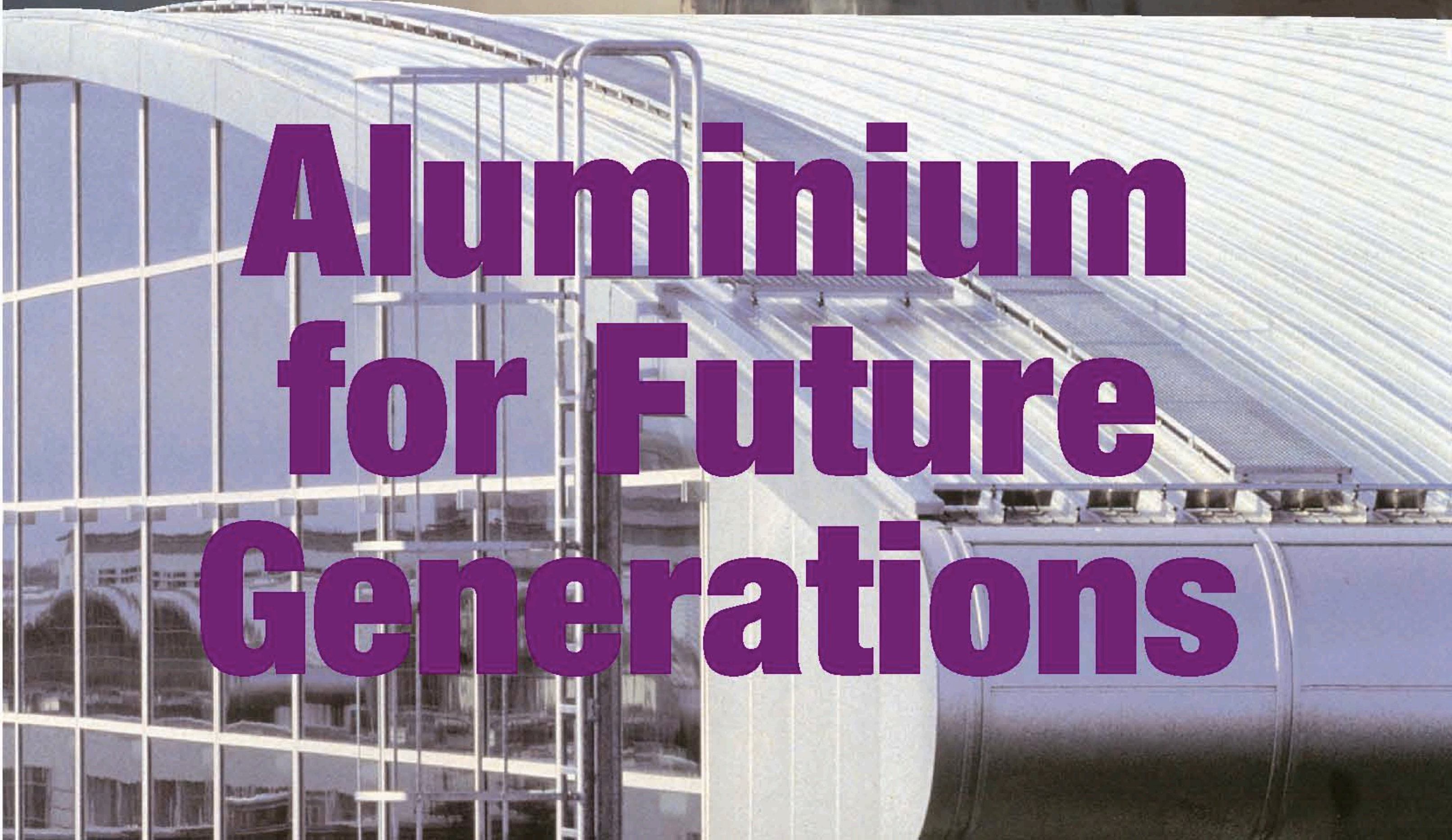
International
Aluminium
Institute

Sustainability Update 2006



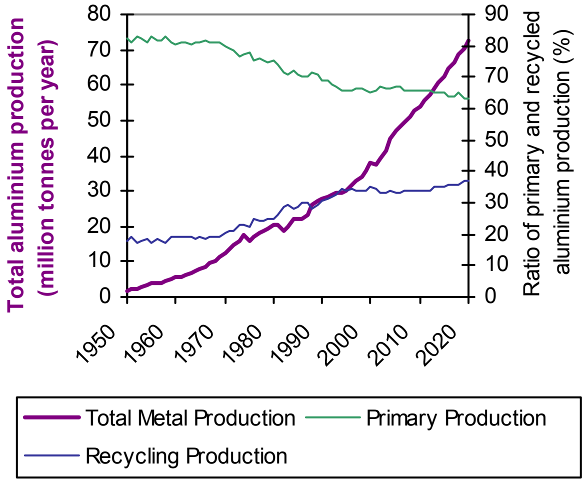
Aluminium for Future Generations

> ***Voluntary Objective 7***
>
> *The industry will monitor annually aluminium shipments for use in transport in order to track aluminium's contribution through light-weighting to reducing greenhouse gas (GHG) emissions from road, rail and sea transport.*

Aluminium shipments to the automotive and light truck industries increased by over 20% in the last five years. Global greenhouse gas savings from the use of aluminium for lightweighting vehicles have the potential to double between 2005 and 2020 to 500 million tonnes of CO_2 per year.

> ***Voluntary Objective 8***
>
> *The IAI has developed a mass flow model to identify future recycling flows. The industry will report regularly on its global recycling performance.*

Aluminium is a metal that can be recycled and re-used almost endlessly. Further, the recycling of the metal uses as little as 5% of the energy that would be required to produce it from raw materials. This property of recyclability means that the world's increasing stock of aluminium acts like an "energy resource bank", over time delivering more and more practical use and value from the energy embodied in the metal at the time of its production. Of an estimated total of over 700 million tonnes of aluminium produced in the world since commercial manufacture began, about three quarters is still in productive use.



The contribution of scrap metal "resource" to the global output of aluminium metal has increased from 17% in 1960 to 33% today and is projected to rise to almost 40% by 2020.

Recycling of post-consumer aluminium now saves an estimated 84 million tonnes of greenhouse gas emissions per year, equivalent to the annual emissions from 15 million cars. Since its inception, the recycling of post-consumer aluminium scrap has already avoided over one billion metric tonnes of CO_2 emissions.

Aluminium recycling benefits present and future generations by conserving energy and other natural resources. The recycling of aluminium requires up to 95% less energy than that required for primary aluminium production, thereby avoiding corresponding emissions, including greenhouse gases. The production of aluminium from scrap also reduces the amount of waste from used products, conserving landfill space. At the end of their useful life, products made from aluminium can be infinitely recycled without any loss of quality to produce new products. That means aluminium can be recycled for use in almost all aluminium applications since its atomic structure is not altered during melting.

The aluminium recycling industry recycles all the aluminium scrap it can obtain from end-of-life products and aluminium by-products. The recycling rate at which end-of-life aluminium is recycled varies depending on the product sector, the lifetime of each product and on society's commitment to collect aluminium. Each application requires its own recycling solutions. Just over 15 million tonnes of recycled aluminium were produced in 2004 worldwide, which met 33% of the global demand for aluminium. Of the almost 7 million tonnes of aluminium recycled from end-of-life products 28% came from packaging, 44% from transport, 7% from building and 21% from other products. Global aluminium recycling rates are high, approximately 90% for transport and around 60% for beverage cans. Aluminium enjoys a high recycling rate of 85% in the building industry. The global industry is keen to increase collection rates and is working with producers of building applications to enable even more efficient collection of scrap from demolished buildings. In 2004 Delft University of Technology conducted a study into the aluminium content of, and collection rates from, demolished buildings in six European countries, which found that the average collection rate for aluminium was close to 96%.

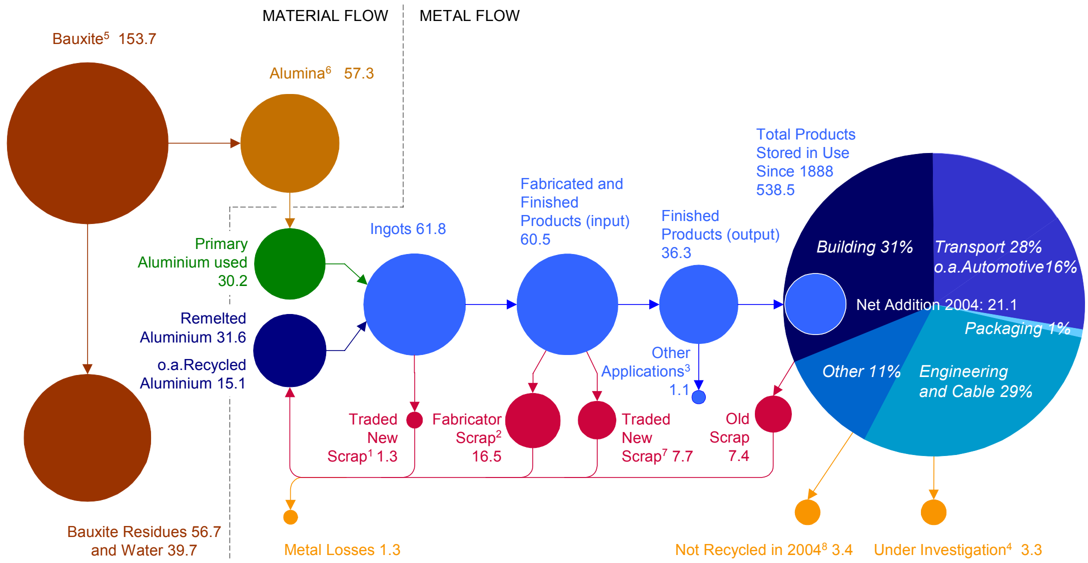
In 2004, approximately 30% of wrought and casting alloys put on the market were used in cars, commercial vehicles, aeroplanes, trains, ships, etc. Increasingly, aluminium products are being employed to reduce vehicle weights, without loss of performance, improving safety and potentially reducing greenhouse gas emissions from vehicles' use-phase. Consequently, the transport sector is also a major source of aluminium at the end of vehicle lifetimes. The transport sector has high rates of recycling, currently about 90% globally because dismantlers and recyclers recognise the high intrinsic value of end-of-life aluminium products. The aluminium industry is working with manufacturers to enable easier dismantling of aluminium automotive components to improve the sorting and recovery of scrap aluminium. The *Japanese Aluminium Association*, for example, is currently undertaking a study of advanced separation techniques to identify ways in which aluminium components from *Shinkansen* 'Bullet Train' carriages can be efficiently separated from other materials, thus increasing the recycling rate and the quality of scrap collected. Electromagnetic sorting is a powerful tool, currently used in many regions of the world, which separates even the smallest aluminium shards from waste material. Applying heat to end of life vehicle parts to separate the lacquer from the aluminium also facilitates recycling.

Used beverage cans are normally back on sale as new beverage cans or other aluminium products in five to eight weeks in those countries which have dedicated can collecting and recycling schemes. Can collection is around 60% globally and in some countries the collection rate is already above 80%. Sweden and Switzerland collect 86% and 88% of their aluminium beverage cans, respectively. Sweden's success lies in a deposit/refund system whereas in Switzerland a voluntary prepaid recycling charge covers the costs of collection. In Japan a collection rate for used beverage cans of 92% is achieved with a voluntary system.

Used aluminium cans are worth six to twenty times more than any other used packaging material. Recycling is not mandatory in Brazil, but every region in Brazil has a recycling market which facilitates the collection and transportation of end-of-life products. This has encouraged communities, supermarkets, condominiums, shopping centres and clubs to collect. As a result in 2005, 96% of cans were recycled in Brazil and this is being considered the world's highest recycling rate for used beverage cans.

To gain additional knowledge about the recycling rates of aluminium contained in consumer durables (e.g., cooking utensils, consumer electronics) and machinery further investigations are under way. The principal limiting factor on increasing the recycling rate is not aluminium itself but the collection of end-of-life product material. Societies, governments and communities need to work alongside the industry to create effective recycling systems to ensure the constant improvement of recycling rates in all applications sectors.

The IAI has designed a mass flow model (critically reviewed by Yale and Delft Technical Universities) to track aluminium throughout its lifecycle from mining to product use to recycling. The main objective for creating the model is to identify present and future recycling flows and the scope for further recycling. The model traces the flow of aluminium from 1888 to the present along the complete value chain. Eight major processes are investigated: bauxite mining, alumina refining, aluminium and aluminium ingot production, fabrication (rolling, extrusion and casting), manufacturing (production and assembly of finished products), use and recycling. New scrap is generated immediately during the production and processing stages, not having yet reached the use phase. Old scrap is generated when an aluminium containing product reaches its end-of-life and is collected for recycling. To calculate the amount of aluminium still in productive use and leaving the use stage a product residence time model is applied. Here the average lifetime of each of the main products in which aluminium is used, and the historical tonnage of aluminium in those products is considered. The results for 2004 are shown in mass flow diagram below.



Values in millions of metric tonnes. Values might not add up due to rounding. Production stocks not shown
1 Aluminium in skimmings; 2 Scrap generated by foundries, rolling mills and extruders. Most is internal scrap and not taken into account in statistics; 3 Such as powder, paste and deoxidation aluminium (metal property is lost) 4 Area of current research to identify final aluminium destination (reuse, recycling or landfilling); 5 Calculated. Includes, depending on the ore, between 30% and 50% alumina; 6 Calculated. Includes on a global average 52% aluminium; 7 Scrap generated during the production of finished products from semis; 8 Landfilled, dissipated into other recycling streams, incinerated, incinerated with energy recovery.

The energy needed for primary aluminium production is stored, to a large extent, in the metal itself. The aluminium metal serves an energy bank. The metal, whether primary or recycled, stores the same amount of energy per tonne. Today, the “energy bank” in use accounts for almost 50 000 petajoules. This is higher than the current combined annual energy demand of Africa and Latin America and is equivalent to the annual total electrical energy generated globally from coal. If this metal is recycled, the banked energy and metal resources can be made available, reducing the energy needed for production by approximately 95%, not just once but repeatedly and benefit future generations. If landfilled, the energy stored is consequently landfilled too and potentially lost forever.

Voluntary Objective 9 & 10

The IAI member companies will seek to reduce their fresh water consumption per tonne of (9) aluminium and (10) alumina produced.

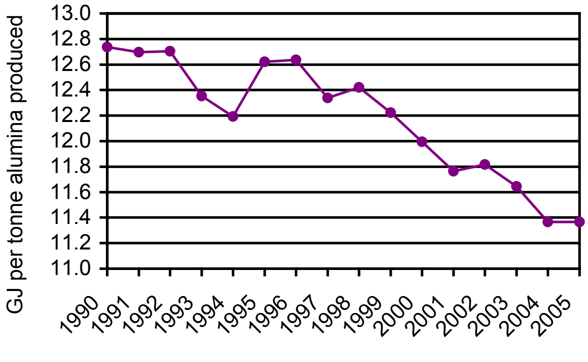
IAI member companies will concentrate efforts to minimise fresh water consumption where there are limited available fresh water resources.

IAI continues to collect data on fresh water consumption. Due to differences between regions and facilities in the definitions of fresh water consumption and in the level of fresh water stress, further analysis and development of indicators is required.

Voluntary Objective 11

The IAI member companies will seek to reduce GHG emissions from the production of alumina per tonne of alumina produced.

The three main sources of GHG emissions from alumina refining processes are fuel combustion, electricity production and energy use in lime production. These three sources are monitored together as the total energy used in alumina production. The average energy used to produce one tonne of metallurgical alumina has decreased by 5% between 1990 and 2004. The IAI is developing a quantitative voluntary objective for alumina refining energy efficiency.



Voluntary Objective 12

The IAI member companies will seek to continue to increase the proportion of bauxite mining land rehabilitated annually.

The area of land rehabilitated as a percentage of land mined since operations began, in currently operating mines, is 70%. Globally, bauxite mining disturbs only 25 km^2 a year, an area equivalent in size to only one third of Manhattan Island, NY. Every year around 20 km^2 is rehabilitated.

Voluntary Objective 13 **New**

The Aluminium industry recognizes that spent pot-lining has properties that makes it a valuable material for use in other processes and will therefore strive either to convert all spent pot lining into feedstock’s for other industries, which include cement, steel, mineral wool and construction aggregate companies or to re-use and or process all SPL in its own facilities.

Pending final deposition, the industry will endeavour to store all spent pot lining in secure, waterproof, ventilated buildings/containers that will maintain the spent pot lining in a dry state with no potential for the build up of noxious gases.

Spent pot lining (SPL) is an unavoidable by-product of the aluminium smelting process, being the material that lines the electrolytic cells known as pots. After time, usually 5-7 years, the carbon and refractory pot lining reaches the end of its useful life and the pots are then taken out of service and relined. On average, 25-35 kg of SPL is produced per tonne of aluminium. In 2005 38% of SPL output was recycled externally out of a total reported output of 331 thousand tonnes of SPL.

The industry has systematically worked to minimize the amount of SPL produced by extending the lifetime of the lining in the smelter pots. Since the 1970s, SPL has been recognised as a valuable resource for other industries, including as a feedstock in the cement, mineral wool and steel production processes. However, the main barrier to supply of SPL as a feedstock has been economics. Individual smelters do not produce enough SPL to provide a continuous supply of feedstock for a cement plant to justify their conversion to receiving this material. Through collaboration with potential customers, and between companies to increase regional supply, the recycling of this material has become more viable and widespread.

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