



UK Aluminium Industry Fact Sheet 3

Aluminium and Sustainability

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Introduction

Sustainability is a property to which every material and organisation aspires and yet most people would find it difficult to give it a precise definition. Such a definition came from the Brundtland Commission of the United Nations in 1987. Sustainability is meeting the needs of the present without compromising the ability of future generations to meet their own needs. Put more succinctly “The world is not ours to own but to act as guardians for generations to come”

Putting this concept into practice, sustainability can be regarded as:

- 1) Social progress which recognises the needs of everyone
- 2) Effective protection of the environment
- 3) Prudent use of natural sources
- 4) Maintenance of high and stable levels of economic growth and employment

In order to monitor the progress towards sustainability it is necessary to develop indicators for economic, environmental and social progress and at regular intervals, perhaps annually, to quantify these indicators. The indicators must be chosen in consultation with all of the stakeholders of, for example the aluminium industry, employees, customers, shareholders, suppliers, legislators, neighbours etc. These indicators must be consistent year to year, be measurable, relevant to the material being studied and easily understood. The UK aluminium industry in association with its stakeholders has developed such indicators and the text below gives examples of the indicators and how they are used to show the progress towards sustainability.

Aluminium can, with justification, be described as the “green” metal. Over the past decade there has been a growing awareness of the toll that our industrialised society takes of the world’s natural resources. Aluminium is a considerable ally in the fight against waste, energy consumption and environmental damage.

The UK aluminium industry can point to a consistent record of improvements with respect to its impact on society, and its products are utilised in every walk of life, with tangible advantages over competing materials, and ultimately simple and efficient recycling.

Aluminium is by far the most widely used non-ferrous metal in the world - this is because aluminium has a unique combination of attractive



and versatile properties. Low weight and high strength, formability, corrosion resistance, recyclability and good conductivity of heat and electricity are just some of aluminium’s important properties.

The new concept of life-cycle analysis of materials and products is fully accepted by the aluminium industry, which is only too happy to see standardised international methods applied to aluminium in its various applications on a ‘cradle to cradle’ basis, and for this unique material to stand up to public scrutiny of its sustainability credentials.

Mining

Aluminium oxide, or alumina as it is known, is the raw material from which aluminium metal is produced. Aluminium oxide is produced from bauxite, an ore mainly found in the tropical and sub-tropical regions of Latin America, South America, Africa and Australia. The world’s known deposits of bauxite are sufficient to support the current production rate of aluminium for another 300 years. Much more is available but beyond this time frame there is little incentive to search for more.

The aluminium industry worldwide takes great care in its mining operations to reinstate land after the bauxite has been dug out. Open cast methods are usually used to mine bauxite, and great care is taken to restore and re-vegetate mine sites following the mineral extraction. The residue of the process which separates aluminium oxide from the bauxite, known as ‘red mud’ is ultimately cleaned and back-filled to the mine as part of this process. Globally, the area rehabilitated each year now equals the area being mined.

Smelting and Power Sources

The manufacture of aluminium requires substantial amounts of electricity. The primary energy expenditure amounts typically to 13 kilowatt hours per kilogram of aluminium. Rio Tinto Alcan's Lochaber smelter in Scotland is powered by the company's own hydro electric plant, which also provides power for the nearby town of Fort William. The Rio Tinto Alcan smelter in Northumberland has its own power station on site.

Work is continuously going on to improve the efficiency of the production process resulting in environmental improvements, lower emission levels and reduced energy consumption.

The UK aluminium industry has invested heavily to increase energy efficiency in production and in improvements to the internal and external environments. Very significant reductions have been made in emission levels of fluorides, sulphur dioxide and dust. The fluorides collected in the furnace gases during "dry scrubbing" are fully recovered. Spent 'pot-linings' are now recycled and no longer destined for land-fill.

The favourable primary energy source when using hydro-electric power, added to the possibility of exporting the energy in the form of aluminium metal, has prompted many producers of primary aluminium to transfer their production to countries where high hydro-electric energy production contrasts with a low number of consumers, such as in Norway or Venezuela.

Around 50% of the electricity used to produce primary aluminium worldwide comes from environmentally-friendly hydro-electric power and other renewable, non-polluting sources. A further 3.5% comes from nuclear power, again substantially free from CO2 emissions.

Recycling

Aluminium is easily and economically recycled. There is an energy saving of 95% in the production of secondary aluminium compared with the production of the same weight of primary metal. Thus it can be seen that the energy invested in primary production is not lost, but remains to encourage repeated recycling of the metal into new products. In total, it is calculated that 75% of all aluminium produced since industrial output began in the late 19th century is still in use today.

The recycling rate for new scrap arising during fabrication is 100%. For some applications, such as lithographic sheet, the recycling rate for old scrap (that scrap recovered after use) is also 100%. In transport applications, the recycling rate exceeds 95%, remembering that vehicles will be in service for many years before they are recycled. In building applications, the recycling rate is 92-98% and the current recycling rate for aluminium packaging is 42% in the UK.

If best technology is used, the quality of this recycled aluminium is equal to the primary metal. The annual production of primary metal in the UK is approximately 200,000 tonnes, with more than double that tonnage recycled in the UK, plus further scrap exported for recycling in other countries.

Aluminium In Use

Automotive Applications

The average European car now contains over 130 kgs of aluminium, (about 10% of the weight), and this level is increasing. This aluminium may be in castings, forgings, or wrought form for the body & structure. The driving force behind this is 'light-weighting', the substitution of steel by aluminium to reduce vehicle weight and thus increase fuel efficiency. Although primary aluminium uses more energy to produce than steel, the fuel saving over the life of the vehicle is around six times the energy invested in producing that aluminium. For 100kg saved on the weight of a car, 0,35 litres of fuel per 100 km is saved. Further savings accrue when the aluminium in the vehicle is recycled into the next generation of cars.

Similar arguments apply to the increasing use of aluminium in commercial vehicles. A lighter vehicle structure permits more goods to be carried per load, resulting in less journeys. From an environmental point of view, the EAA estimates

that, over its whole lifecycle, 1 kg of aluminium introduced in a truck saves more than 20 kg of CO₂. Again this is a positive environmental impact from the energy invested in the aluminium production.

Packaging

Across Europe, around 17% of all aluminium is used in packaging. This takes many forms, from the ubiquitous beverage can, to other food cans, aerosols, trays, tubes, foils and laminates. These are attractive to both packagers and consumers, and contribute to our economy by, not only weight reduction arguments as above, but by the barrier properties of aluminium which extends shelf-life of products and thus reduces wastage. Additionally, this packaging is recyclable, indeed the beverage can is probably the most recycled consumer item, and can be recycled, remanufactured, refilled and back on the shop shelf within six weeks.

Building & Construction

This sector is also a major consumer of aluminium. It is extensively used in windows, curtain walls, roofing and cladding, solar shading, solar panels etc., as well as in some structural applications. Factors that make aluminium a preferred choice for so many applications are high strength-to-weight, forming methods which aid design flexibility, long, low-maintenance service life, attractive, durable finishes, and ultimately the certainty that at the end of the building's useful life the aluminium will be recycled to begin another useful life.

As with automotive use, aluminium incorporated into building design is likely to save much more energy throughout the life of the building than was consumed in its initial manufacture. This is because aluminium building systems help in maximising solar gain during winter months, and also in minimising it during summer months. The net result is a significant increase in efficiency of fuel consumption for both heating and air conditioning.

Other Sustainable Development Factors

The UK aluminium industry remains a major employer, with around 20 000 direct UK employees in an industry with a turnover of around £2.5bn.

This is an established industry which continues to invest to compete on a global basis and bears comparison with world leaders.

Across Europe, employee incomes in the industry are over 6% above average.

Health & Safety performance of plants has shown steady improvement, and an aluminium industry Sector Scheme, known as 'AIMS', continues to support this process.

The UK aluminium industry operates a sector Climate Change Agreement which has run for more than 10 years and continues to hit demanding energy reduction targets.

Taking account of the many sustainability indicators that the industry uses, covering environmental, economic and social factors, aluminium is a truly sustainable engineering material.

More detail can be accessed by downloading the Sustainability Report of the European Aluminium Association <http://www.eaa.net/en/publications/sustainability-report/>

Also available is an Environmental Profile report based on robust Life Cycle Inventory data for aluminium products

<http://www.eaa.net/en/environment-health-safety/lca/environmental-profile-report/>