

ALUMINIUM FOR FUTURE GENERATIONS SUSTAINABILITY UPDATE 2005

Aluminium is a young material and, in little more than a century since its first commercial production, it has become the world's second most used metal after steel. The demand for aluminium products is increasing year by year, with aluminium the metal of choice for leading designers, architects and engineers, all of whom are looking for a material which combines functionality and cost-effectiveness with forward looking form and design potential.

Aluminium is an extraordinarily versatile material. The range of forms it can take and the variety of surface finishes available mean it lends itself to a wide range of products, many of which we use every day of our lives.

As well as its adaptability of form, the metal's light weight (up to 33% that of steel) and numerous material qualities – represented by a wide range of alloys – mean that products have been designed for use in all areas of modern life. It is a good conductor of electricity (one kilogram of aluminium cable can carry twice as much electricity as one kilogram of copper) and most overhead and many underground transmission lines are made of aluminium. It transmits conducted heat and reflects radiant heat, making it an excellent medium from which to produce cooking utensils and foils, radiators and building insulation. Its strength, combined with low density, make it ideal for transport and packaging applications. Aluminium is a unique metal: strong, durable, flexible, impermeable, lightweight, corrosion-resistant and one hundred percent recyclable.

Aluminium products are helping to meet the sustainability challenge, shared by all nations, industries and communities, to provide for the basic needs of an increasing global population and to meet their expectations for improving quality of life whilst simultaneously protecting the environment.

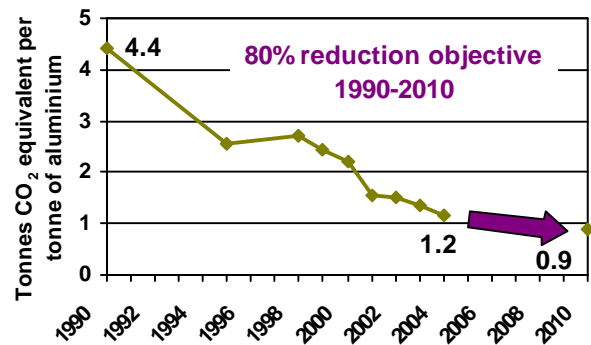
The *Aluminium for Future Generations* initiative is a programme of continuous improvement on the part of the aluminium industry, overseen by the *International Aluminium Institute* (IAI). It comprises twelve voluntary objectives, covering all key phases of aluminium's life cycle. The industry's performance towards meeting these objectives is measured annually against twenty two performance indicators. The number of voluntary objectives is increasing year by year.

This update reports on the progress recorded in the second IAI global annual sustainability survey of IAI Member Companies. These companies are responsible for over 70% of global aluminium production and around 20% of recycled metal production. For further information, see the IAI website at www.world-aluminium.org.

PROGRESS ON THE ALUMINIUM INDUSTRY'S VOLUNTARY OBJECTIVES

Voluntary Objective 1

An 80% reduction in Perfluorocarbon (PFC) greenhouse gas emissions per tonne of aluminium produced for the industry as a whole by 2010 versus 1990 levels.



Perfluorocarbon (PFCs) are formed in the aluminium smelting process during brief upset conditions known as 'anode effects'. PFCs are potent global warming gases and have long atmospheric lifetimes. The aluminium industry has been engaged in a PFC emissions reduction programme for a number of years, with considerable success. PFC emissions from the global aluminium industry were reduced by 74% per tonne of aluminium produced between 1990 and 2004. This represents a reduction equivalent to over 3 tonnes of CO₂ per tonne of aluminium produced.

Voluntary Objective 2

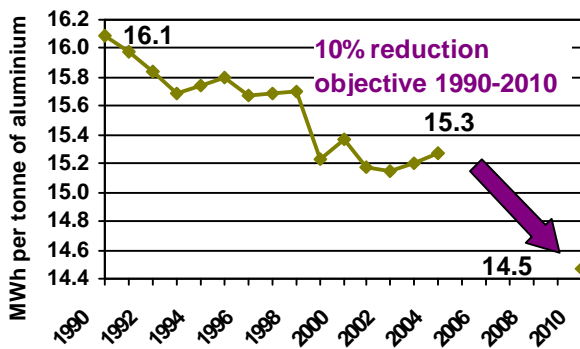
A minimum of a 33% reduction in fluoride emissions by IAI Member Companies per tonne of aluminium produced by 2010 versus 1990.

Data collected from Member Companies indicates a 64% reduction in total fluoride emissions (gaseous and particulate) per tonne of aluminium produced between 1990 and 2004 (18% since 2000). **The Voluntary Objective is scheduled for review in the light of these results.**

Voluntary Objective 3

A 10% reduction in average smelting energy usage by IAI Member Companies per tonne of aluminium produced by 2010 versus 1990.

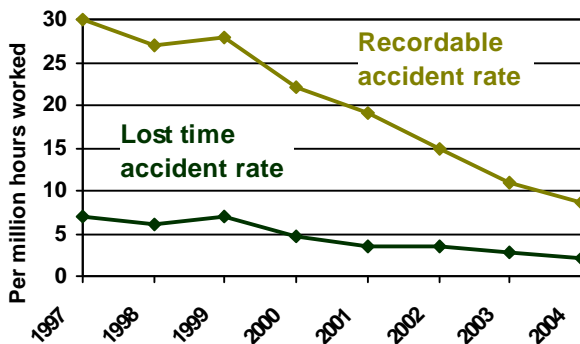
The average electrical energy required for electrolytic production of one tonne of aluminium has been cut by 5% between 1990 and 2004.



Voluntary Objective 4

A 50% reduction in the lost time accident rate and recordable accident rate by 2010 versus 2000 by IAI Member Companies, with a review in 2006.

The recordable accident rate at IAI Member Company plants (mines, refineries and smelters) has been cut by 60% over the period 2000-2004. The lost time accident rate has been reduced by 55% over the same period. **This Voluntary Objective is also scheduled for review in the light of these results.**



Voluntary Objective 5

Implementation of Management Systems for Environment (including ISO 14000 or equivalent certification) and for Health and Safety in 95% of IAI Member companies' plants by 2010.

ISO 14000 Environment Management Systems and OHSAS 18000 Health and Safety Management Systems are in place at the majority of IAI Member Company plants – 92% of reporting plants have such formal and documented systems in place.

Voluntary Objective 6

Implementation of an Employee Exposure Assessment and Medical Surveillance Programme in 95% of IAI Member companies' plants by 2010.

Employee exposure assessment and medical surveillance programmes are in place at 92% of IAI Member Company plants (mines, refineries and smelters). A detailed industry-wide definition of the

criteria required to meet this Voluntary Objective has been developed and shared between IAI Member Companies. This document provides the basis for the development of exposure assessment and medical surveillance programmes at those plants which do not already have such systems in place.

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 5.5% between 2002 and 2003. 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 CO₂ per year.

Voluntary Objective 8

The IAI has developed a mass flow model to identify future recycling flows. The industry will report annually on its global recycling performance.

The model projects that global recycled metal supply (back to the industry) from post-consumer scrap will double by 2020 from the 2004 level of 6.7 million tonnes.

Voluntary Objective 9

New

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Voluntary Objective 10

New

The IAI Member Companies will seek to reduce their fresh water consumption per tonne of alumina produced and will report annually on progress.

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

IAI Member Companies are committed to reducing their fresh water consumption in high water stress areas. The IAI is collecting data on fresh water consumption to track facilities' performance.

Voluntary Objective 11

New

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 lime 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 emissions reduction.

Voluntary Objective 12

New

The IAI Member Companies will seek to continue to increase the proportion of bauxite mining land rehabilitated annually; IAI will report annually on the proportion of area rehabilitated to area mined.

Globally, bauxite mining disturbs approximately 25km² a year, an area equivalent in size to only one third of Manhattan Island, NY. Every year around 20km² is rehabilitated. While the annual area mined increased by 25% between 1998 and 2002, the area rehabilitated increased by 33% over the same period. The rehabilitation of areas disturbed by bauxite mining is an essential part of sustainability allowing mining to be a temporary land use that does not compromise other uses in the future.

WORKPLACE AND COMMUNITY HEALTH

Healthy workforces are key to the sustainability of both the workplace and local communities. Health related workplace hazards and their concomitant risks have been identified and are being controlled by IAI Member Companies. Control measures include

- *Replacement of materials and processes with lower risk materials or processes;*
- *Engineering controls to decrease workers' exposure to certain risks (such as the enclosure of noisy processes);*
- *Use of work practice controls to lessen ongoing exposures (for example work-rest cycles in hot climates);*
- *Job rotation to minimize ergonomic risks;*
- *Provision of personal protective equipment when other control measures are not available.*

Health assessments are often offered for employees (and required by regulation in some countries) to ensure early detection of disease. A significant benefit of this approach is that it also provides an opportunity for prevention of disease through the exchange of information between health professionals and employees. Very often the information provided to the employee has implications for improving community health, for example programmes on nutrition and exercise. In many communities, occupational health professionals are also actively enhancing the overall

health of local populations through their community roles.

Case Study: Malaria Prevention

Commitment to community sustainability is continuously demonstrated by IAI Member Companies. For example, *BHP Billiton* operates plants in Mozambique and Northern Brazil, two regions where malaria significantly impacts on public health. The disease affects the ability of these regions to provide sustainable workforces for the operations and the health of employees and their families also has an impact on productivity and safety. Around 40% of Africa's public health funding is spent on fighting the disease, a major barrier to the continent's economic growth.

In October 1999 BHP Billiton joined the *Lubombo Spatial Development Initiative* to eradicate malaria throughout southern Africa. The initiative has proven a remarkable success:

- *Malaria-related fatalities around the Mozal smelter in Mozambique have been reduced by 86%, with significant reductions in the prevalence of the parasite;*
- *In KwaZulu-Natal, South Africa, malaria incidence decreased by 96% in the 2002/2003 season compared to the 1999/2000 season;*
- *In all the areas covered by the malaria control programme malaria is no longer a primary cause of absenteeism from schools.*

BHP Billiton has since extended its involvement, by funding research for new anti-malarial drugs in partnership with the *Medicines for Malaria Venture* (MMV). MMV is currently managing the largest-ever portfolio of anti-malarial drug research.

Case Study: Community Healthcare

In India, IAI Member Company *Hindalco* is addressing health issues through their sustained presence in local communities. Social projects are carried out under the aegis of the *Aditya Birla Centre for Community Initiatives and Rural Development* and span five key areas including community health and family welfare, incorporating:

- *Mobile clinics which doctors visit once a week;*
- *Medical camps - general and issue-based;*
- *Health training and awareness;*
- *Sanitation through the provision of toilets, training, smokeless cookers and biogas;*
- *Safe drinking water;*
- *Mother and child health;*
- *Reproductive health.*

SAFETY IN THE WORKPLACE

The improvement in the industry's accident rates has been driven by many factors, including increased top management attention and commitment, more systematic accident follow up and increased involvement of the workforce, as well as mechanization and automation as a means to improving technical conditions.

While continuing to improve on these rates, the industry is now focusing on reducing the severity of accidents. Most serious accidents involve mobile equipment and cranes and other lifting devices. Priority areas are therefore:

1. *The concentration of management actions on the operation of mobile equipment, cranes and lifting devices;*
2. *Improving rules, procedures and work standards;*
3. *Improving equipment design and engineering;*
4. *Improving training in the use of equipment;*
5. *Addressing behaviour based safety.*

The IAI has developed a set of safety guidelines for mobile equipment. These are based on the shared procedures and experiences of a number of aluminium companies in managing the risks involved in mobile equipment and pedestrian segregation. These guidelines have been made available to all Member Companies. Further guidelines on cranes and lifting devices are also being developed.

RESOURCE EFFICIENCY

Bauxite Residue

Bauxite residue (also known as red mud) is a by-product of alumina production. The amount of residue generated, per tonne of alumina produced, varies greatly depending on the type of bauxite used, from 0.3 tonnes for high grade bauxite to 2.5 tonnes for very low grade.

Bauxite residue is most often disposed of in land based residue storage areas using one of a variety of methods. Residue storage areas can have a high land use value following closure and rehabilitation and can be used to grow crops or other vegetation. Alternatively, the land can be used for building, depending upon the moisture of the residue. The industry is investing significant amounts in research in an effort to reduce the environmental impact of residue disposal and to improve its resource use efficiency.

Continuous improvement in bauxite residue storage practices and the design of storage areas have helped to create conditions for early recuperation, to reduce the area required for storage, to increase further the stability of deposits and to enhance the efficiency of operations.

Caustic soda is valuable to the bauxite refining process, so recovery is maximised wherever possible. The alumina industry's efficient use of caustic soda is both good business practice and good environmental practice. Bauxite residue is extensively washed to recover valuable soda and dissolved alumina and closed water circuits are operated wherever possible to maximise the recovery of soda. Leachate from storage areas is also collected and recycled to the process. Bauxite residue has a high pH as a result of small amounts of residual caustic, but bauxite residue per se is not toxic.

Spent Pot Lining

An unavoidable by-product of the aluminium smelting process is spent pot lining (SPL), 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. The SPL has significant energy content from the carbon lining and other beneficial characteristics for utilisation, for example, in cement production – but also includes both fluorine and a small amount of cyanide absorbed over the operational life of the pot. SPL is required to be stored in dry conditions pending re-use or processing to avoid contact with water leading to the formation of flammable gases.

On average, 25-35kg of SPL is produced per tonne of aluminium. The industry has systematically worked to minimize the amount of SPL produced by extending the lifetime of the lining in the smelter pots.

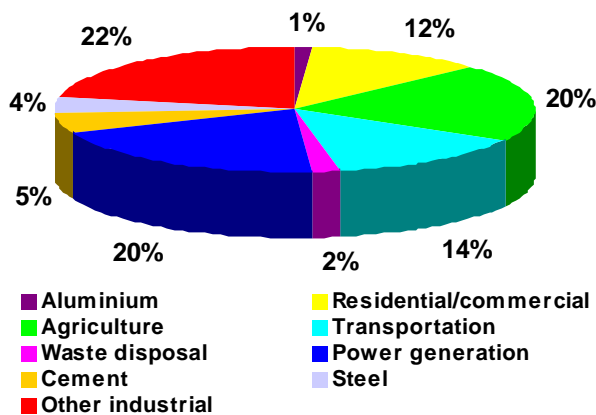
Since the 1970s, SPL has been recognised as a valuable resource for other industries, including as a feedstock in the cement, mineral wool and steel production processes. However, the main barrier to supply of SPL as a feedstock has been economic. For example, individual smelters do not produce enough 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.

The aluminium industry recognizes that SPL has properties that make it a valuable material for use in other processes and will therefore strive to convert all SPL into feedstocks 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 re-use or processing, the industry will endeavour to store all SPL in secure, waterproof, ventilated buildings/containers that will maintain the SPL in a dry state with no potential for the build-up of noxious gases. The industry will monitor progress and report annually.

CLIMATE CHANGE

The full process of manufacturing new stocks of aluminium is responsible for 1% of the global human-induced greenhouse gas emissions that scientists with the *Intergovernmental Panel on Climate Change* (IPCC) identify as a cause of unnaturally accelerated rates of global warming. Onsite (direct) emissions in the production of primary (new) metal are responsible for 0.4% and offsite (indirect) emissions in the production of the energy fed into the smelting process account for the other 0.6%. To put the total for aluminium in perspective, it is less than the entire emissions output of Australia (about 1.4%), a modern industrial nation of 20 million people. In effect, this level of output is also equivalent in annual emission terms to sixty million cars.



Aluminium production is responsible for only 1% of man-made GHG emissions

The IAI employs a lifecycle approach to address the challenges of climate change, focusing not only on direct emissions (those emitted from within aluminium industry facilities) and the energy required to produce aluminium products, but also on the energy savings to be made through their use, recycling and reuse. It is in products' use phases that the majority of energy is required.

The IAI has therefore developed a four-pronged strategy to meet the challenges of climate change encompassing the full lifecycle of the metal, from production and use, to recycling and reuse: These are:

1. *To reduce greenhouse gas emissions per tonne of metal produced;*
2. *To increase energy efficiency in aluminium production;*
3. *To maximize the collection and recycling of used products;*
4. *To promote the lightweighting of vehicles.*

REDUCING EMISSIONS

Benchmarking, the sharing of good practice and technological developments have led to a 74% reduction in PFC emissions per tonne of aluminium since 1990. In fact, even though the production of aluminium has increased by 44% since 1990, overall global greenhouse gas emissions from the production process have been reduced by 32%

The future continued improvement in the production process of aluminium with respect to these emissions can be guided by benchmarking data and a focus on the worst performing plants.

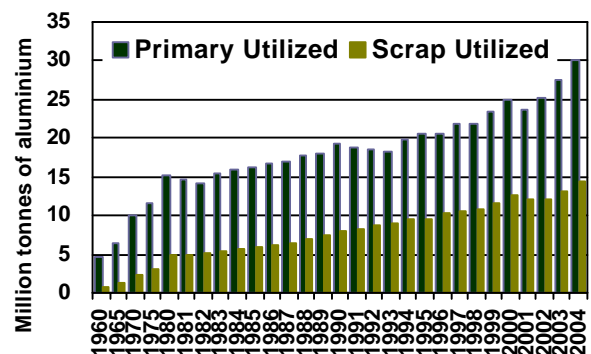
Technological improvements, through capital investment and from industry partnerships and voluntary objectives, together with a plant wide approach to emissions improvements (e.g. fume treatment, HVAC) and broader view at the life cycle of aluminium will all contribute to the industry's continuing success in its drive to reduce emissions.

ENERGY EFFICIENCY

Collaborative good practice has also allowed the industry to achieve a 5% decrease in its energy consumption per tonne of aluminium from 1990 to 2004, reducing the associated emissions that are released into the atmosphere. Since aluminium was first commercially produced in the 1880s, the average energy used to smelt one tonne of the metal has decreased by 70%.

RECYCLING

Aluminium is a metal that can be used, recycled and re-used almost endlessly. Further, the recycling of the metal uses only 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 manufacture. 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.

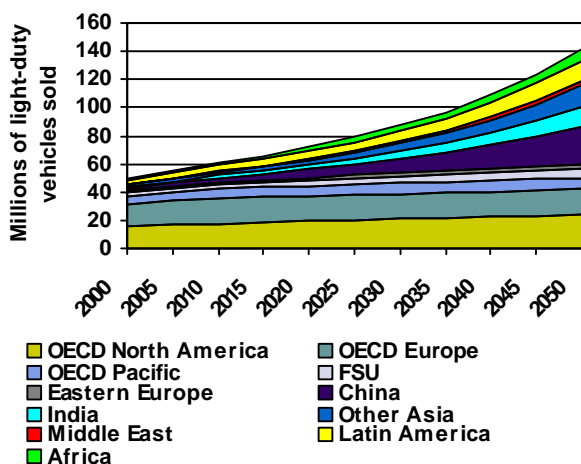


The contribution of this post use metal “resource” to the global output of aluminium products has increased from 17% in 1960 to 33% today and is projected to rise to almost 40% by 2020.

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 CO₂ emissions.

VEHICLE LIGHTWEIGHTING

Encouraging the use of aluminium in transport – a sector which is responsible for a third of global greenhouse gas emissions – is an innovative, business-led path to sustainable growth, aimed at boosting sales of aluminium while helping to provide better, more efficient and less-polluting transport options. The rapid growth of road transport makes this an important objective in combating climate change.



Source: International Energy Agency

The use of lightweight aluminium components in a vehicle’s construction can save six to twelve times the energy taken to produce the primary aluminium used in its construction via the consequent reduction in the fuel consumed by the lightened vehicle. Up to eight per cent of the fuel that the vehicle uses over its lifetime can be saved for every 10% reduction in weight. Through this fuel saving, every kilogram of aluminium that is used in substitute for heavier materials in a car or light truck, has the potential to avoid the release of 20kg of CO₂ over the lifetime of the vehicle.

Aluminium shipments to the automotive and light truck industries increased by 5.5% between 2002 and 2003. Global greenhouse gas savings from the use of aluminium in lightweighting vehicles have the potential to double between now and 2020 to 500 million tonnes of CO₂ per year.

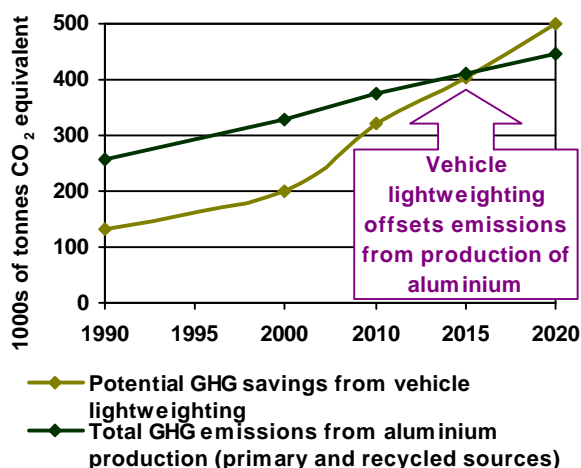
A recent study, commissioned by the IAI, and carried out by the *Institut für Energie und Umweltforschung* (IFEU) shows that even greater savings can be made in

other forms of transport. For example, aluminium use in a standard ferry could save around four times as much CO₂ per kg of vehicle weight reduction than in a standard petrol car. High speed ferries can potentially save ten times this again over their lifetimes. The potential for lightweighting in a variety of transport applications, and indeed in the lightweighting of packaging, secures this metal as part of the solution for a sustainable future.

CLIMATE NEUTRALITY

The goal for 2020 or beyond is for aluminium to help in saving more greenhouse gas emissions than it creates directly and indirectly through its production. This objective over time of ‘climate neutrality’ is defined by the industry as the point at which greenhouse emissions, saved by the replacement of traditional energy inefficient materials with aluminium, especially in transport applications, exceed emissions caused by all production of aluminium.

With current progress in the IAI key strategy areas – direct greenhouse gas emissions reductions, decreased energy consumption (with consequent improvements in indirect emissions), increased recycling of the metal and savings owing to shipments to the transport area – the goal of ‘climate neutrality’ in accounting for the industry’s own direct and indirect emissions could be achieved by 2020. By this date, forecasts show that lightweighting of road vehicles alone could save 500 million tonnes of greenhouse gases.



Widespread adoption of best practice in smelter operations, in recycling and in vehicle lightweighting, together with savings from building and packaging products, could equate to higher savings even sooner.



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