ALUMINIUM

By Angus MacMillan

Having spent a considerable time in the doldrums the aluminium market began to experience a marked revival during the final quarter of 2003. Indeed, prices rose steadily throughout most of the period, pausing only once to consolidate, as the LME three-month contract rose to US$1,605/t on the final day of the year. This was its highest level since February 2003 and almost US$300 higher than the low of the year of US$1,320/t recorded in April.

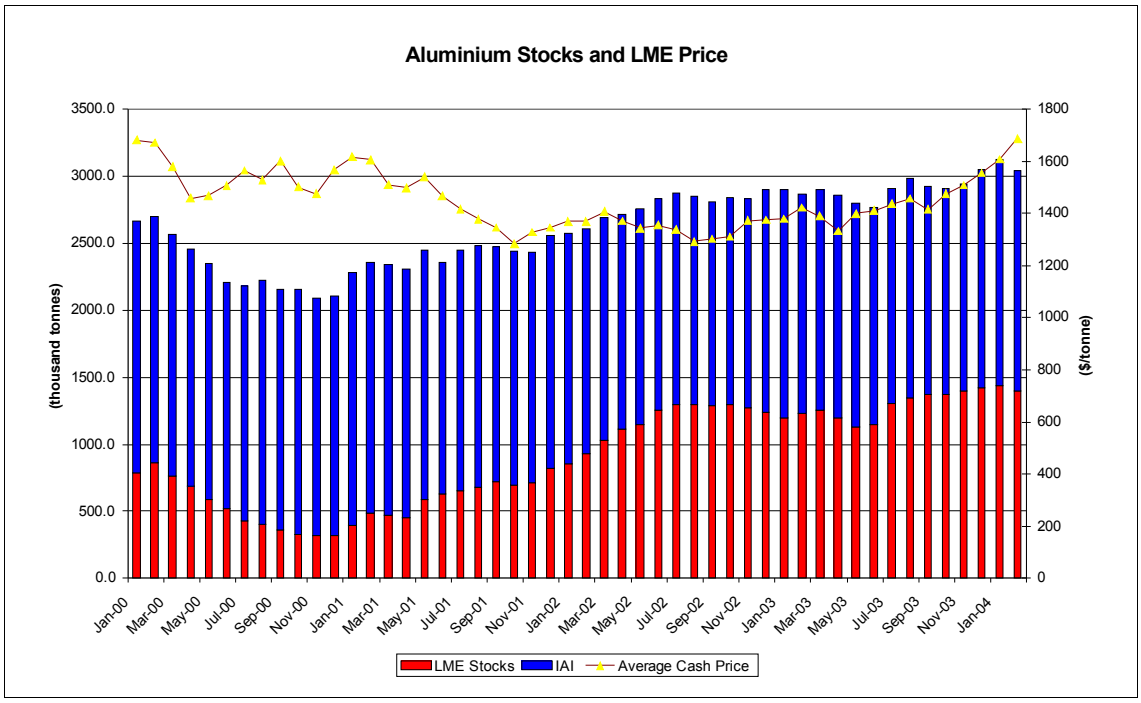
Far from being underpinned by fundamental considerations, the rally was driven by speculative buying as funds turned their attention to the base metals complex as a whole. In fact, LME stocks rose by 51,000 t in the final quarter, rounding off a year during which they rose by 185,000 t. While consumption did increase by over 5% in 2003, despite the weak economic conditions in some regions, this was not sufficient to prevent another substantial accumulation in reported and off-market stocks. Not only did Western production continue to rebound, but imports from the former Soviet Union (FSU) and China increased.

The International Aluminium Institute (IAI) reported that total stocks held by producers in its reporting area changed little during the course of 2003, holding at around the 3.0 Mt mark. Similarly, unwrought inventories moved little from the 1.6 Mt level throughout the year.

LME stock levels fluctuated during the first half of the year, falling from 1.24 Mt at the start to 1.19 Mt in mid-February, before rising to 1.27 Mt in mid-March. They then began to fall again and by mid-June were down to 1.12 Mt. However, it was pretty much one-way traffic thereafter, and by the end of the year they had climbed to 1.42 Mt, some 185,000 t above their level at the start of the year.

As the figure below indicates, combined IAI and LME primary stocks remained substantial at the end of 2003. Indeed, they stood at their highest level since 1995. However, reported stocks tell only part of the story in this market and the true surplus in 2003 was close to 500,000 t.

The exact volume of stocks being held off-warrant on finance deals is a matter for conjecture and estimates vary widely, but there seems little doubt that they continued to accumulate 2003.



Bauxite

The production of bauxite takes place in a comparatively small number of countries and output is concentrated in only a few of these. In 2003, Western world production totalled 131.4 Mt, of which 89% was accounted for by the six major producing nations. Of these Australia was by far the largest contributor, its 55.6 Mt amounting to 42% of the Western total, followed by Brazil (13.5%), Guinea (12.5%), Jamaica (10.0%), India (7.2%) and Venezuela (4.1%). (Table 1)

There are five bauxite mines operating in Australia, the largest being Huntly which produced 18 Mt in 2003, making it easily the world's largest mine. In fact, Huntly alone produced more bauxite than any other single country. Weipa, the country's second-largest mine, produced 11.9 Mt. During 2003 Comalco announced that it intended to invest US$150 million to expand production at Weipa to 16.5 Mt/y by the end of 2004.

Brazil is the West's second-largest producing country, its output totalling 17.7 Mt in 2003. The bulk of this material came from the giant Trombetas mine, which produced 14.4 Mt in 2003, or 81% of the Brazilian total. The mine is in the process of being expanded and the operator, Mineracao do Rio Norte (MRN) announced that it intended to produce 17 Mt in 2004 and 17.4 Mt in 2005. Production will expand elsewhere in the country, following the announcement by Cia Vale do Rio Doce (CVRD) of its intention to spend US$83.2 million in 2004 to start work on the Paragominas bauxite mine, which will have an initial capacity to produce 4.5 Mt/y when it becomes operational in 2006. The mine will supply feed for the expansion of the Alunorte alumina refinery at Barcarena in which CVRD has a 75% controlling interest.

Guinea, the world's third-largest producing country, mines bauxite at three locations, the largest of which by far is the Boke complex. In 2003 it produced 12.1 Mt, accounting for 74% of the country's total output of 16.4 Mt. Sangaredi, which was brought on stream in 1973, is by far the largest mine in the Boke complex and, indeed, output from the other mines is now believed to be minimal. In 2001, the Russian aluminium producer RusAl, signed a preliminary agreement to develop the huge Dian-Dian bauxite deposit, but encountered problems obtaining the finance to do so. It is hoped that the deposit, which has known reserves of 550 Mt, will eventually produce 12 Mt/y. RusAl plans to build an alumina refinery, deep-water port and railway at Dian-Dian, although the timing remains uncertain. Having already been awarded the contract to manage the Kindia mine, which produced 2.1 Mt in 2003, RusAl took a majority stake in the Alumina Company of Guinea, which operates the Fria Kimbo bauxite mine. In 2003, it produced 2.3 Mt.

India's bauxite production has increased significantly over the past two decades. About a quarter of the country's output comes from a plethora of small mines, while Nalco's Panchpatmali mine is by far the country's largest producer, accounting for over 50% of output. Nalco has plans to increase annual capacity from 4.8 Mt to 6.3 Mt, although the timing of such a development is uncertain. Elsewhere, the Orissa government has committed 150 Mt of bauxite reserves to Sterlite Industries for the bauxite/alumina operations it is constructing in the state.

Venezuela did not produce its first bauxite until 1987 but is now the West's sixth-largest producer, albeit some way behind India. All the country's production comes from CVG-Bauxilum's Los Pijiguaos mining complex, which has been expanded over the past few years.

Elsewhere, Indonesian nickel and gold producer PT Aneka Tambang announced that it would undertake a feasibility study of the Tayan bauxite reserves in Kalimantan. The company is seeking partners to help finance development of the 108 Mt deposit.

Alumina

Since the mid-1970s the trend in the geographical pattern of production has been away from the major metal-consuming and smelting regions towards the major bauxite-producing countries. As with bauxite, production has become increasingly concentrated, and in 2003 the six major producing nations accounted for 76% of Western output compared with 70% in 1990 and 65% in 1980. (Table 2)

Given the dominance it enjoys in the bauxite sector, it is no coincidence that Australia has emerged as the world's major alumina producer. In 2003 it accounted for 36% of Western output of 46.3 Mt. Australia is home to the world's largest alumina refineries, and in 2003 three of the country's six operational plants each produced over 3.0 Mt. The largest, Gladstone produced 3.7 Mt, which was beyond its design capacity of 3.6 Mt/y.

Pinjarra, the second-largest refinery, produced 3.4 Mt, and the owner, Alcoa World Alumina and Chemicals (AWAC), recently received approval from the Western Australian government to expand capacity to 4.2 Mt/y. Work will begin in early 2004 and should be completed by the end of 2005.

Although US alumina production has declined over the past two decades it remained the West's second-largest producer in 2003, albeit only just, with output well below that of Australia. Production was in fact constrained by Ormet's decision to mothball its 600,000 t/y Burnside refinery in late 2002 and keep it closed throughout 2003. The impact of this decision was more than offset by marginal increases at the Sherwin and Point comfort plants. In late 2003, Ormet announced that it intended to reopen Burnside.

During the 1980s and 1990s, Brazil greatly expanded its alumina production capacity and by 2000 had become the West's third-largest producer. In 2003 its output of 4.7 Mt was marginally lower than that of the US, accounting for 10.2% of Western production.

Output rose by over 20% in 2003, largely reflecting a sharp increase at Alunorte's Barcarena refinery, where annual capacity is being expanded from 1.6 Mt to 2.4 Mt. Sao Luis, the country's second-largest refinery, and CBA's Sorocaba plant, both recorded small increases in output in 2003.

Jamaican alumina output reached its highest level in 29 years in 2003, according to the Jamaica Bauxite Institute. There are three refineries in the country, all of which increased their output. The largest, Nain has recently been expanded and is expected to produce at its full increased capacity of 1.65 Mt/y in 2004, having produced 1.53 Mt in 2003.

India's six refineries produced 2.9 Mt of alumina in 2003. Over half this total came from Nalco's Damanjodi refinery, which produced 1.56 Mt. The company completed an expansion programme at the plant from 1.05 Mt/y to 1.58 Mt/y in 2001 and in early 2003 submitted a proposal to the government to expand capacity to 2.1 Mt/y. A programme gradually to expand capacity at Hindalco's Renukoot refinery to 700,000 t/y is ongoing and last year it produced 620,000 t compared with 570,000 t in 2002. Indal's Belgaum and Muri refineries achieved incremental increase in output in 2003.

Looking ahead, there are plans at various stages of development to build three greenfield refineries in India, although none is likely to see the light of day soon. Sterlite Industries began clearing ground at the site of a 1.4 Mt/y refinery at Lanjigarh in eastern Orissa, although the timetable of the project is uncertain. Elsewhere in Orissa, plans by Indal to construct a 1.5 Mt/y refinery have run into several delays and little progress was made in 2003. The third proposed project, by Gujarat Alumina & Bauxite, to construct a 750,000 t/y refinery in the Kutch region, was put on the back burner in 2003, after two US-based backers dropped out.

All of Suriname's alumina output comes from Suralco's Paranam refinery, which produced marginally over 2 Mt in 2003 compared with 1.9 Mt a year

earlier. In November 2003, Alcoa announced that it had started a 250,000 t/y expansion of the plant to raise capacity to 2.2 Mt/y by July 2005.

Although it has declined in recent years, European alumina production of 6.3 Mt in 2003 was by no means negligible, but was spread among seven countries, each of which operates one refinery. Ireland was the largest producer, its Aughinish refinery accounting for 1.55 Mt. Spain's San Ciprian refinery produced 1.33 Mt, up slightly from 1.30 Mt in 2002, and Porto Vesme in Italy increased its production marginally to 1.02 Mt. Output in France, Germany, Greece and Turkey was little changed in 2003.

Elsewhere, Venezuela produced 1.85 Mt in 2003. CVG Bauxilum's Cuidad Guyana refinery is being expanded and should reach capacity of 2.0 Mt/y by the end of 2004. A feasibility study is being undertaken with a view to raising capacity to 3 Mt/y by 2009. In Canada, Alcan's Vaudreuil refinery held output steady at 1.2 Mt in 2003.

Guinea, which exports the vast bulk of its bauxite output, produced 732,000 t of alumina at its Kimbo refinery, up from 700,000 t in 2002. RusAl announced that it had begun a feasibility study for a US$350 million project aimed at doubling the refinery's capacity. The company expects to complete the study by the end of 2004. Global Alumina Products Corp (Gapco) of Canada plans to develop a 2.8 Mt/y capacity refinery at Boké, with first production set for 2008

Market developments

Although total Western alumina production increased by 5.9% in 2003 and metallurgical grade output rose by an even greater 6.1% to 43.9 Mt, well in excess of the 3.2% rate of increase in Western primary aluminium output, the alumina market tightened significantly. As we note later, this reflected a marked increase in Chinese alumina imports from the West.

This development resulted in a sharp increase in spot alumina prices, which traded higher throughout the year. Fob Western Australia spot material was quoted at around US$360-380/t in December, compared with US$170-180/t in January, and cif alumina was quoted in the US$400-420/t range.

Western world aluminium consumption

Aluminium is an extremely versatile metal, employed in a wide range of industries in a large number of applications. The key properties that make aluminium so popular are its lightness, resistance to corrosion, high electrical and thermal conductivity and the fact that it is non-magnetic and non-sparking. Also, the metal is malleable and, therefore, easily worked by the major manufacturing and shaping processes, ie, rolling, extrusion forging and casting. In almost all its applications it is alloyed with other metals in order to increase its strength and machineability.

- **Transport:** Although the metal is widely employed in various aerospace (mainly airframes), rail (freightcars, coaches) and marine (hulls, propellers) applications, this sector is of course dominated by the automobile industry. It will be developments there that will largely determine the underlying rate of growth of aluminium's use in the transport sector in the years ahead. Aluminium's low density, high strength and durability are the properties which enable it to enjoy acceptability in such a wide range of applications, in combination with the move towards increased per-unit use at the expense of other metals, and the upward trend in global vehicle production. These factors will play their part in the metal's greater acceptance in the future, although the rate of increase in vehicle production will remain subject to cyclical influences.

  Aluminium's major attraction for vehicle manufacturers is its lightness, allowing reductions in vehicle weight which are required in the major markets (and increasingly in developing ones) to meet mandated, and increasingly stringent, fuel economy standards. Many manufacturers have switched to aluminium for cylinder heads, engine blocks, sumps and transmission casings, although not necessarily for all models. Aluminium, currently, has the highest consumption level of any base metal in the automobile industry and by far the greatest potential for future demand growth in absolute terms.

- **Packaging:** The vast majority of aluminium going into the packaging sector is employed in the form of cansheet, the other uses being foil and a small number of food containers. Cansheet has a number of applications, but by far the most important is the production of beverage cans, although aerosol cans have also continued to increase in importance. There is considerable geographical diversity in the consumption of aluminium semis in the packaging sector, largely reflecting the differences in per capita beverage can consumption between one country and another. Although the metal will face increasing competition from steel (tinplate) and PET, there remains considerable scope for further growth, especially in a number of developing countries and Eastern Europe.

- **Construction:** To some extent, the relative failure of aluminium to make significant gains in the construction industry can be explained by the fact that in this sector the metal is used in a diverse number of applications where it faces competition from a wide range of other metals and materials. Whereas in some of its other end-uses aluminium is virtually price inelastic in the short term, the same cannot be said of the majority of its applications in the construction sector where it can be easily substituted. This is the most diverse sector in which aluminium is employed and, in its various applications, it competes with timber, plastics, coated steels, lead, zinc, cast iron and concrete. Growth, particularly in the mature economies, is likely to remain modest and subject to cyclical influences.

- **Other end-uses**: Aluminium is used in a wide range of applications in the engineering and consumer goods sectors. In the electrical engineering sector it is chiefly used in the form of power cables, magnet wire and busbars. In mechanical applications its resistance to corrosion make it popular in such applications as hydraulic systems, welded structures, bearings and heat exchangers. It is also used in consumer goods, such as white goods, garden furniture, and cookware. The outlook for these other end-uses, taken together, is for reasonable growth, particularly in the developing economies.

Latest available figures show that Western world consumption of primary aluminium rose by a healthy 5.4% in 2003, which was a marked improvement on the 3.3% growth recorded the previous year. Indeed, consumption of 20.8 Mt was a new record high, surpassing the 20.4 Mt consumed in 2000, the previous peak year.

Consumption in North America continued to rebound strongly in 2003 and it increased by 3.4%, having risen by 2.3% in 2002, although at 6.7 Mt it remained below its all-time peak of 71 Mt recorded in 2000. In fact, all the growth was accounted for by a 4% increase in US consumption in response to a steadily strengthening economy. Canadian consumption fell slightly.

Western Europe also made a positive contribution to Western consumption growth in 2003, recording a 5.6% jump to 6.4 Mt. Growth, however, was rather patchy, with some countries recording strong upturns, and others falling or stagnating demanded. Germany, by far the region's largest consumer, increased its consumption by 6.6% to 1.8 Mt, French consumption stagnated and in the UK it fell by 11.2%. Elsewhere, both Italy and Spain recorded good growth, with consumption rising by 10.6% and 14.1% respectively. During the past few years Spain has overtaken the UK as the region's fourth-largest consumer, and Italy has nudged France into third place.

Japanese consumption fell for the third consecutive year in 2003, as the economy remained in the doldrums and industrial output continued to be weak. Consumption of 1.95 Mt was 2.5% down on its 2002 level and 13.3% lower than its recent peak in 2000. In fact, Japan's highest-ever consumption of 2.47 Mt occurred in 1996, which gives some idea of the prolonged economic malaise that has afflicted the economy.

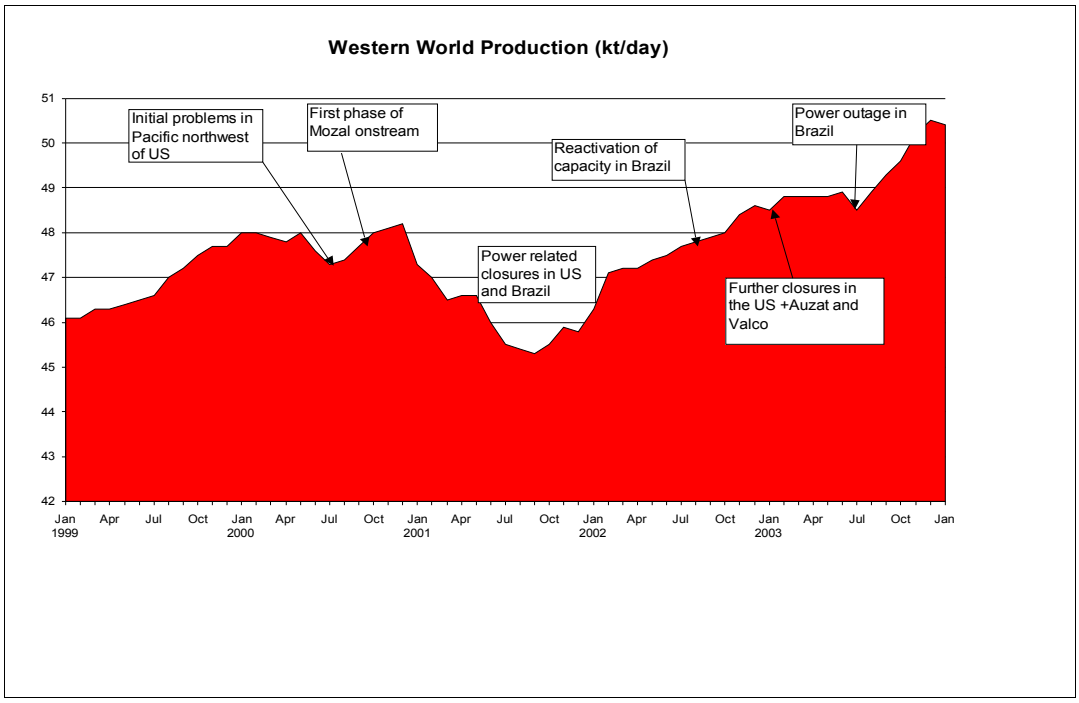
It is worth noting that in the early stages of development, economies are able to make rapid gains in metal consumption as the intensity of use rises sharply. However, as economies mature the service and high technology sectors become more important and constitute an increasingly larger share of GNP. Thus, in a mature industrialised economy, whereas metal intensity of use is higher, the growth rate will be much lower than in an economy which is at an earlier stage of development. In 2003, the 15.1 Mt of primary aluminium consumed in North America, Western Europe and Japan represented 72.6% of total Western consumption, compared with 80.0% in 1990, 85.7% in 1980.

To a considerable extent, growth of Western aluminium consumption over the past two decades or so has relied on the developing countries of Asia. Although the Asian financial crises caused a hiccup in 1998, the trend has otherwise been strongly positive. Initially South Korea and Taiwan made the running in the 1970s and early 1980s. In fact, in 2003 the former country was the West's fourth-largest consumer, albeit some way behind Germany. To all intents and purposes, both South Korea and Taiwan are mature industrialised economies and in recent years countries such as Thailand, Indonesia and Malaysia have picked up the baton as consumption in these countries has expanded from relatively low bases. In 2003, with the exception of Malaysia, all these countries enjoyed healthy growth. However, the star performance in 2003 came from India, where consumption jumped by a fantastic 38%, moving it from being the West's seventh-largest consumer to its fifth-largest, placing it ahead of Canada and France in a single bound.

Western aluminium production

Figures from the International Aluminium Association (IAI) indicate that Western production of primary aluminium in 2003 increased by 3.2% to 17.94 Mt, from 17.37 Mt in 2002. The average daily operating rate in 2003 rose to 49,100 t, compared with 47,600 t the previous year. As the figure below indicates, production has fluctuated significantly over the course of the past few years, reflecting a number of interruptions to supply, but, even though a considerable amount of capacity continues to remain mothballed, the underlying trend since the middle of 2001 has been upwards.

Production increased in all of the IAI's reporting regions in 2003, reflecting a combination of restarts and new capacity being brought onstream.



Africa

The IAI figures show that African production totalled 1.43 Mt in 2003, up 3.9% from the 1.37 Mt produced in 2002. The increase reflected higher output in both Mozambique and South Africa, which more than offset lower output in Ghana.

In Mozambique, BHP Billiton announced in September that the Mozal II expansion had been completed seven months ahead of schedule, raising the plant's capacity to 545,000 t/y. The company later announced that it had also brought the 135,000 t/y expansion of its Hillside smelter in South Africa on stream several months ahead of schedule, raising the plant's capacity to 665,000 t/y. Production of the first metal had been scheduled for the first quarter of 2004 but was in fact achieved at the beginning of October 2003.

The Tema smelter in Ghana has long been plagued by misfortune resulting from low water levels affecting hydroelectricity supply, and there appears little relief in sight. Valco mothballed its last operating potline in May because of lack of power availability. At that time the company said that it would consider reopening two of the plant's five potlines at the end of the rainy season in September or October, but later noted that the rainy season could last through to November and there has been no change in the smelter's status. Kaiser signed a Memorandum of Understanding with the government, under the terms of which the government will guarantee to supply power from January 2006 onwards. Until then, it appears that the smelter will be supplied on a 'best-effort' basis.

Nigeria's 193,000 t/y Ikot Abasi smelter remained mothballed throughout 2003. The smelter was brought on stream in late 1997 but between then and mid-1999 (when it closed) it managed to produce just 40,000 t of metal. Various attempts by the Nigerian Government to dispose of its majority stake in the management company Alscon have ended in failure. The outlook for the smelter remained uncertain at the end of 2003, although RusAl and Ferrostaal had both expressed an interest in taking a controlling stake.

In Egypt, Egyptalum announced that its plans to raise capacity at its Nag Hammadi smelter to 300,000 t/y are two years ahead of schedule, and expects to finish upgrading all potlines in 2005. The plant, which is Egypt's only primary smelter, produced around 200,000 t in 2003.

Western Europe

Output in Western Europe rose to 4.07 Mt in 2003, an increase of 3.6% from the 3.93 Mt produced a year earlier. A number of countries recorded marginal increases, but the only notable rise occurred in Norway, and French output declined.

In February 2003, Pechiney announced that it intended to close its 50,000 t/y Auzat smelter in the French Pyrenees in the summer, noting that the plant faced a substantial increase in power costs after the existing contract expired in 2004.

The company faced considerable opposition from its employees, but events overtook it in March, when electrical accidents resulted in the enforced closure of the smelter.

The long-term future of the 163,000 t/y Distoman smelter in Greece, 60.2% of which is now under the control of Alcan following its takeover of Pechiney, has been called into question. The Canadian company noted that a strengthening euro and rising energy prices had adversely affected the plant's competitiveness. Distoman purchases power under a long-term contract, which expires on March 31, 2006.

In Norway, Hydro Aluminium reported that it expected to complete the final phase of the 240,000 t/y expansion of its Sunndalsora smelter by the second quarter of 2004, three months ahead of schedule. Separately the company announced that it would close a combined 70,000 t/y of capacity at its Aardal and Hoyanger smelters by the end of 2006, because the Soderberg technology that some potlines employ will not meet more stringent government emission targets. The company undertook intensive assessments before concluding that converting the old potlines was not economically viable. After the capacity is shut, Hoyanger will have a capacity of 172,000 t/y and Aardal 54,000 t/y. Previously Hydro had noted that it would close 120,000 t/y of capacity at the Karmoy smelter by end-2009.

In Iceland it appears that Nordural of Iceland has overcome the problems it faced in obtaining power supplies to allow it to double capacity at its Grundtartangi smelter to 180,000 t/y. In 2003 the company signed agreements with Sudernes Heating Service and Reykjavik Energy, and each will build an 80 MW power plant to meet the expanded plant's requirements. If things proceed on schedule, the expansion should be up and running at full capacity by June 1, 2006, according to the company. Originally, Nordural had hoped to begin construction in 2004 and begin production in 2005, but the state-owned power company Landsvirkjun, which was to provide 47% of its energy requirements, said that it could not begin construction of the necessary power plant until 2007. The company has plans to extend the smelter by a further 60,000 t/y by 2009.

Asia

Asia recorded the highest proportional increase of all the IAI areas in 2003. Output of almost 2.48 Mt was 9.5% higher than the 2.26 Mt produced in 2002, mainly reflecting a substantial increase in Indian output and marginal increases elsewhere. Asian output will continue to expand strongly over the next few years, largely as a result of ambitious expansions in Dubai and Bahrain.

Dubai Aluminium produced just over 560,000 t in 2003, compared with 536,000 t in 2002, following the completion of an expansion of its Jebel Ali smelter. The company announced that the expansion project that will boost the plant's capacity to 710,000 t/y is on schedule for completion by mid-2006.

Aluminium Bahrain (Alba) reported that it produced 530,000 t of aluminium in 2003, an increase of 2.5% on the 517,000 t produced in 2002. The higher output was attributed to capacity creep and low activity in pot relining last year. However, because of the increased need for pot relining this year, production is expected to decline slightly to 522,000 t in 2004, according to the company. It was also noted that construction of a 307,000 t/y fifth potline was still on course for completion by March 2005. Plans to expand potline four by 23,000 t/y were approved earlier and this should be onstream by 2005. Upon completion of these expansions the Knuff smelter will be the largest in the world outside Russia.

Meanwhile, it appears that Alba's proposed sixth potline project, which would add a further 307,000 t/y of capacity, making Knuff the largest smelter in the world bar none, has been put on the back burner. In September the Bahrain Government signed a MoU with Alcoa, whereby the US company would take a 26% stake in Alba, paving the way for a sixth potline. However, it was later announced that plans for the sixth potline had been shelved.

In India, Hindalco continued with the expansion of its Renakoot smelter from 242,000 t/y to 345,000 t/y. The company had intended completing the expansion in September, but noted that it did not expect to bring it totally on stream until the first half of 2004.

India's other major expansion, that of Nalco's Angul smelter, fell further behind its revised schedule in 2003. The company had originally intended completing the expansion in December 2002, but pushed this back to late 2003 having already brought 50% of the cells into operation. In April 2003, however, it announced that full operation would not be achieved until March 2004.

Indal intends to increase the capacity at its Hirakud smelter in Orissa from 65,000 t/y to 100,000 t/y, through a combination of moving equipment from its closed Belgaum smelter in Karnataka, and raising the plant's efficiency. The company has already raised Hirakud's capacity by moving half of Belgaum's 400 pots in 2002 and a further 58 pots late last year. The company is now awaiting environmental clearance before transferring the remaining pots from Belgaum, which it was forced to close in 1995 when the regional government raised power rates.

In Indonesia, having been plagued by water shortages for a number of years, Nippon Asahan of Indonesia noted that improved water levels in Lake Toba have allowed it to increase production at its Kuala Tanjung smelter in northern Sumatra.

Output in the April-September period totalled 106,000 t, an increase of 31% on the 81,000 t produced a year earlier. The company stated that it expected production in the year to March 2004 to reach 210-220,000 t, compared with 163,000 t in 2002/03.

Latin America

Latin America produced some 2.28 Mt of primary aluminium in 2003, up 2.0% from 2.26 Mt a year earlier, as output continued to recover from the setback in 2001 resulting from power shortages in Brazil and technical problems in Venezuela. Production was also constrained by the gradual run down and eventual closure of the Vera Cruz smelter in Mexico in August.

The Brazilian Aluminium Association reports that the country produced some 1.38 Mt of primary aluminium in 2003, an increase of 4.7% on 2002. Output increased despite a power failure at the Sao Luis smelter, which the company estimated cost 60,000 t in lost production from planned levels. Production increased at all the other Brazilian smelters, most notably Sorocaba and Belem, where expansions were completed during the course of the year. Table 3 lists production by each of the country's seven smelters during 2002.

Alcoa has warned that its future investment plans in the Brazilian aluminium industry are being placed in jeopardy by uncertainties about electricity supplies. As noted above, the company lost a significant amount of production at its majority-owned Sao Luis smelter because of a power outage in July. It believes that existing power market rules actively discourage new investment. Alcoa's latest statement follows an earlier expression of concerns by Valesul. Apparently there are no current plans to expand Valesul's 93,000 t/y capacity, refuting earlier rumoured intentions to raise capacity in stages to 229,000 t/y.

By way of contrast, CBA, part of the Votorantim group, which is in the process of raising capacity at its Sorocaba smelter from 240,000 t/y to 340,000 t/y, plans to invest more than US$500 million in increasing it further to 500,000 t/y by 2009. As part of the project, the company intends to construct an alumina refinery and three hydroelectric plants. The three power plants, which are scheduled for completion by the end of 2005, will enable the company to remain 60% self-sufficient in energy. The energy investment will allow the company to remain competitive, and costs are estimated at US$1,100/t.

Venezuela's two smelters produced a combined 605,502 t last year, which was marginally higher than the 605,230 t produced in 2002. Alcasa produced 172,157 t, up from 170,478 t in 2002, and Venalum produced 433,345 t, down from 434,752 t. Meanwhile, it is reported that Alcasa has received US$185 million to finance the construction of its long-awaited fifth potline. Construction will start after completion of a feasibility study and should take 36 months, raising the smelter's capacity from 210,000 t/y to 450,000 t/y.

Production at the Aluar smelter in Argentina remained stable at 265,000 t in 2003. The company has long-standing plans to expand its Puerto Madryn smelter, but these were put on the back burner because of the country's financial crisis, which delayed construction of a new power grid. Now Electro Ingeniera has been awarded a contract to construct and maintain a transmission line linking the national and Patagonian grids.

The new line will not only reduce the operating costs of the smelter, but will also facilitate the expansion plans. Construction of the new power line could start in April and take about 20 months to complete. Aluar was presumably confident of such a development, as it announced earlier that it would proceed with the first 120,000 t/y phase of an expansion in early 2004. This will raise the plant's capacity to 400,000 t/y. The company intends to raise capacity to 620,000 t/y over an eight-year period.

Plans to build a greenfield smelter in Chile ran into more problems in 2003. Noranda has been promoting its 440,000 t/y Alumysa project since the 1980s and recently revived its interest, after having allowed it to lie dormant for many years. However, once again things have not gone smoothly, and the project was the subject of numerous environmental complaints.

North America

In 2003, North American production continued to recover from its slump in 2000/01. It did so despite the fact that considerable smelting capacity remains mothballed in the Pacific Northwest of the US. In fact, the bulk of the modest 1.5% increase in the region's output of some 5.5 Mt resulted from higher output in Canada.

Table 4 details the status of the ten smelters in the Pacific Northwest at the end of 2003. As can be seen, a number have gone for good, and the future of the remainder remains uncertain.

In April Alcoa announced that it would was reducing production at its two Massena, New York smelters by 60,000 t/y, or about 24% of their combined 255,000 t/y capacity. The cuts came only four months after the company announced that it had arranged a US$7 million temporary economic incentive with the New York Power Authority to reduce the Massena East smelter's operating costs, and had reduced the workforce. The company stated that the capacity would remain mothballed as long as market conditions warranted.

Towards the end of the year, Ormet, announced that it would close two of the six potlines at its Hannibal smelter in order to free alumina for sale in the spot market, having restarted the 600,000 t/y Burnside refinery in October. The plant was mothballed in February 2002, at which time the company was able to buy alumina more cheaply on the spot market than it cost to produce it. Rising alumina prices throughout 2003 persuaded Ormet that operating Burnside was again profitable and, indeed, selling some of its output on the spot market was preferable to running the smelter at full capacity.

In Kentucky, the long-term future of Alcan's 190,000 t/y Sebree smelter and Century's 235,000 t/y Hawesville plant have been called into question beyond 2010/11, when power contracts with LG&E Energy Marketing expire. A Kentucky county court judge called a forum with elected officials, development officers, representatives from Big Rivers Electric Corp and aluminium industry officials to discuss the issue.

Thousands of jobs in the state would be at risk if the smelters were forced to close. Big Rivers Electric is exploring options to ensure a future power supply, including the possibility of constructing a new coal-fired power plant.

Citing outdated technology and high production costs, Alcan announced that it intended to close its 90,000 t/y Arvida smelter in Quebec, Canada. The plant, which uses Soderberg technology, is to be closed by the end of the second quarter of 2004. The company noted that the smelter had the highest production costs of all its Quebec facilities, and that the appreciation of the Canadian dollar over the past year had contributed to its decision to close the plant.

In March, Alcoa announced that it had signed a memorandum of understanding with the Quebec Provincial Government to expand its Deschambault smelter. The expansion will increase capacity from 250,000 t/y to 570,000 t/y, and will be supplied with 500 MW of electricity from Hydro Quebec. Construction is scheduled to begin in 2006, with first production two years later. However, Alcoa suspended the modernisation programme at its Baie Comeau smelter, pending further discussions with the provincial government. The company noted that, having reached an agreement in principle in 2002, it could not continue to invest in the project without a firm commitment on the part of the Quebec authorities, which had raised the question of possible energy restrictions.

Oceania

Oceania recorded a small 1.3% increase in primary aluminium output in 2003, to almost 2.2 Mt, reflecting marginal increases at a number of smelters in Australia which more than offset lower production at New Zealand's Tiwai Point smelter.

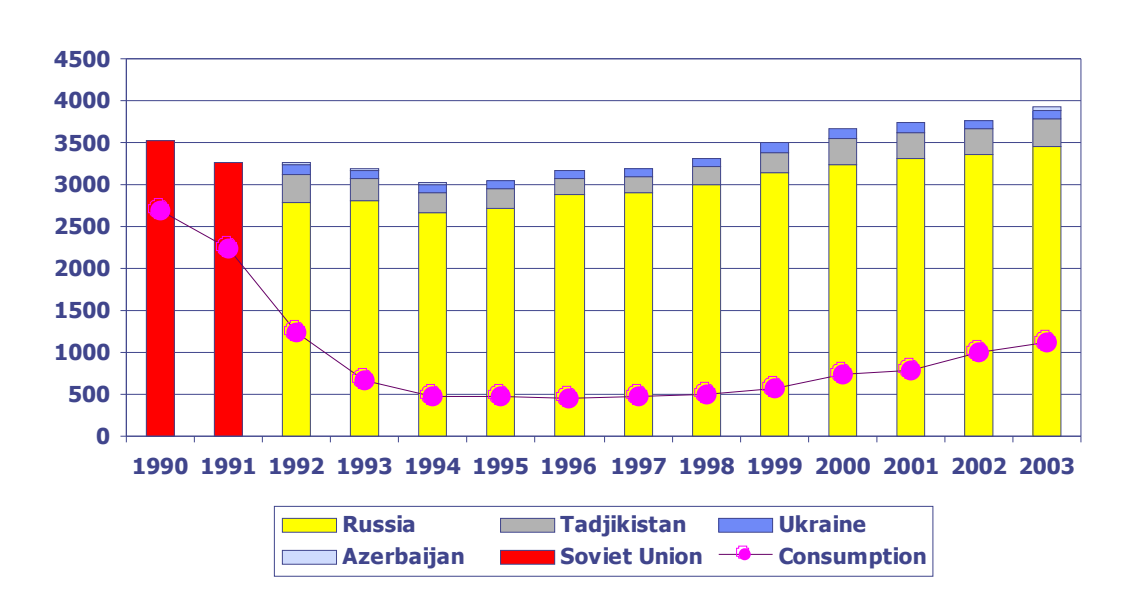
Comalco denied rumours that it intended to close its 330,000 t/y Tiwai Point smelter because of rising energy prices, having been forced to reduce its operating rate by 30,000 t/y because of a spike in the power price earlier in the year. The plant returned to full operation during the third quarter. The company is considering a range of options with regard to power supplies in order to keep the smelter competitive in the longer term. It said that closure of the plant was not an option under consideration. Until recently Tiwai Point was located in the third quartile of the industry cash-cost curve but recent increases in power costs will have pushed it closer to the upper end.

Aldoga Aluminium, which plans to build a greenfield smelter at Gladstone in Queensland, agreed an export credit facility with China's Foreign Engineering and Construction Co worth A$770 million, covering the supply of Chinese equipment and technology to the project. The two groups have also agreed to examine the possibility of developing bauxite mining and alumina refining in Australia. The intention is to construct a 420,000 t/y smelter at a cost of A$2 billion, with a start-up date of 2006. In 2003, the Australian Government gave environmental approval for a 560,000 t/y smelter at the proposed site.

The former Soviet Union

Following the break-up of the Soviet Union, the widely held consensus was that much of the region's old (by Western standards) smelting capacity would close. Indeed, during the early 1990s it looked as if this would indeed be the case, as a series of financial and logistical problems resulted in output dropping steadily. By 1994, annual production had fallen to 3 Mt from 3.5 Mt in 1988. However, 1994 proved to be the nadir and since then output has increased steadily, exceeding Soviet-era levels for the first time in 2000. In the early 1990s, when production was falling, consumption was collapsing, with the result that a huge surplus became available for export. In the late 1980s, the FSU had around 750,000 t/y of aluminium available for export, but by the middle of the following decade this had risen to around 2.5 Mt/y.

Production and consumption in the former Soviet Union ('000 t)



In 2003, production increased by 4.4% to 3.93 Mt from 3.76 Mt in 2002. Russia accounts for the bulk of the region's output, producing about 3.48 Mt, an increase of 4.0% on 2002 production of 3.35 Mt. Production increased at most of the country's existing smelters and a new plant, albeit a rather small one started up.

RusAl raised output at all of its four smelters, taking its total production for the year to 2.59 Mt. The most notable increase occurred at Sayansk, where production rose by 10.9% to 459,000 t, from 414,000 t in 2002. Bratsk, the world's largest smelter, produced 931,000 t, up 1.6% from the previous year. Krasnoyarsk, which is only marginally smaller, raised its output by 4.5% from 865,000 t to 903,000 t, and Novokuznetsk, the company's smallest smelter, recorded an increase of 2.8%, from 288,000 t to 296,000 t.

RusAl's smelter-modernisation programme led to cell amperage increases at all its smelters. Dry anode technology was introduced at Bratsk, Krasnoyarsk and Novukuznetsk, and dry scrubbers were installed at Krasnoyarsk. As well as improving operational efficiency, these developments also helped to reduce the environmental impact of the operations. The company noted that as a result of various technological and upgrade programmes it expected to increase output by 50,000 t in 2004.

SUAL, meanwhile, announced that it had produced 890,000 t in 2003, up 28% from a year earlier. The significant increase, however, largely reflects the inclusion of the Volkhov and Volgograd smelters in the company's portfolio for the first time, although a major upgrade at the Uralsk smelter saw output there rising by 11.3%. In 2004, the plant will operate at its fully expanded capacity, which will make it the largest contributor to SUAL's projected 30,000 t increase in total output.

The first new smelter to come on stream in Russia since 1985 did so in 2003, in the form of an 11,200 t/y capacity pilot plant at Tayshet in the Irkusk region. Construction of the smelter began in 2002 by investment company Alucom-Invest and, in June 2003, RusAl became a partner. The operation of the plant will be reviewed early in 2004 and a decision made about its future. If the decision is made to proceed with the development of the project, the intention is to build four pot rooms each with a capacity of 62,500 t/y the first of which would come on stream in 2005, with full capacity of 250,000 t/y achieved in 2008. (Table 5)

Looking ahead, there are ambitious plans in place to modernise and expand a number of FSU smelters. RusAl, for example, is spending around US$350 million on modernisation programmes at its Krasnoyarsk and Sayansk smelters, which will raise their combined capacity by over 100,000 t/y by 2006/07. The Sayansk project is due for completion by 2006 and will raise the plant's capacity by 5.5% to 480,000 t/y, and Krasnoyarsk's capacity will rise by 9% to 989,000 t/y by 2007. As well as this, there are plans to construct a 300,000 t/y expansion at Sayansk. It is intended to lay foundations in 2004, with first output targeted for 2006.

SUAL, meanwhile, has plans to increase the capacity of its Kandalaksha smelter from 70,000 t/y to 318,000 t/y. The first phase, to raise capacity by 30,000 t/y, came on stream towards the end of 2003. It is planned to begin construction of the 218,000 t/y KAZ-2 project in 2005. Further ahead, the company has plans to build a greenfield alumina/aluminium complex in the Komi region, using bauxite from its Sredni Timan bauxite deposit. The company is seeking a strategic partner, but noted that it would proceed with the project on its own if necessary. The intention is to construct a 1.4 Mt/y alumina refinery and a smelter of up to 500,000 t/y capacity.

The Sumgait smelter in Azerbaijan, closed in 1995 and reopened briefly in 1999, reopened again in 2003, hopefully on a more permanent basis. The intention is to produce 30,000 t in 2004.

According to Azerbaijan's Economic Development Minister, the capacity of the smelter will be raised to 75,000 t/y over the next two years. The Dutch company, Fondel, which manages the country's aluminium group Azeraluminium, plans to invest US$50 million in upgrading the plant. It also intends to construct a new 100,000 t/y smelter near the old one, with the first 50,000 t/y stage expected on stream in 2005.

Tadjikistan's primary aluminium production increased by 3.4% in 2003 to 320,000 t. The country's sole producer TadAZ has been raising output gradually over the past few years and announced that it intended to produce 348,000 t in 2004. The smelter was commissioned in 1975 with a nameplate capacity of 517,000 t/y, but has never operated at anything like this level.

Ukraine's sole aluminium producer, Zaporizhsky Alyuminievy Kombitat (Zalk) increased its primary aluminium output by 1.6% in 2003 to 107,400 t compared with 105,800 t in 2002. The company noted that it intended to increase output at the 110,000 t/y plant in 2004, but gave no indication of by how much.

During 2003, Swiss company Coriga AG purchased a 31.76% stake in the Pavlodar alumina refinery from the Kazakh Government, with the intention of commencing construction of the country's first aluminium smelter. The first 60,000 t/y stage of the US$850 million project is scheduled to be completed by December 2007, with capacity being increased in stages to 240,000 t/y.

Bauxite and Alumina

The FSU is endowed with a very poor bauxite resource base. Despite this, both Russia and Kazakhstan have established and maintained significant alumina refining industries. Plants in the Urals and in Kazakhstan treat locally-mined bauxites (although in both cases limited imported material has also been processed in recent years). Other Russian plants process nepheline or alunite for the recovery of alumina, the largest of which is Achinsk. The two Ukrainian refineries Zaporozhye and Nikolaev process bauxite imported from Western countries (usually Guinea, Jamaica, Brazil and Greece).

Bauxite is mined at four locations in Russia. Between them, they produced 5.58 Mt in 2003. By far the largest operation is the Sevuralboksitruda mine in the northern Urals, which produced 3.44 Mt or almost 62% of the total. SUAL, which controls the complex, has invested in its expansion in recent years, as it has in the Sredni Timan mine, with the result that output has increased at both. It is expected to increase further in the years ahead, particularly at Sredni Tinan, which produced 985,000 t in 2003 and where capacity could reach 2 Mt/y by 2005.

Kazakhstan is also a significant bauxite producer, with output of 4.7 Mt in 2003. Alyumini Kazakhstan operates two mines, at Krasnoctyabrsky and Turgay, and they produced 2.7 Mt and 2.0 Mt respectively in 2003.

Production at both has increased in recent years, although we are not aware of any plans to raise it further in the near future.

The Zeylik mine in Azerbaijan, produces alunite rather than bauxite, and would normally supply the country's Ghyandia refinery. However, it has been closed for some years and, as far as we are aware, there are no plans to reopen it in the near future.

Production of alumina in the FSU has also been increasing in recent years, reaching some 6.24 Mt in 2003. As Table 6 indicates, output has risen in all the producing countries in recent years. Russia is the largest producer, accounting for just over 50% of the total.

Bogoslovsk has a nameplate capacity of 1 Mt/y, but figures released by SUAL indicate that it has been operating above that rate since 2000. The company also owns the Uralsk and Pikalevo refineries, both of which increased output in 2003, albeit marginally so in the case of the latter. (Table 6)

Production at Bauxitogorsk has fallen in recent years, and in August 2003 the company announced that it would cease producing smelter-grade alumina and concentrate on making specialised and higher-value products. However, we are not aware that it has yet done so.

Achinsk, owned by RusAl, is Russia's second-largest refinery and in 2003 it produced some 1.05 Mt. The company has invested in the plant in recent years and production has risen as a result. The same is true of the Nikolaev refinery in Ukraine, where RusAl is the majority shareholder, and capacity is expected to increase to 1.3 Mt/y by 2005 as a result of a US$50 million investment programme. Ukraine also produces alumina at the smaller Zaporozhye refinery, where output has also been raised and is expected to increase slightly in 2004.

Kazakh Aluminium's Pavlodar refinery produced 1.45 Mt of alumina in 2003, compared with 1.42 Mt in 2002. Most of the plant's output is shipped to Russian smelters, chiefly Bratsk and Krasnoyarsk. Capacity is being increased and should reach 1.5 Mt/y in 2005.

The Ghyandia refinery in Azerbaijan doubled its output to 200,000 t in 2003, having restarted production in May 2002 after a short closure. Apparently, Azeraylyuminy plans to raise the plant to full capacity operation of 475,000 t/y, but the timing of any such development remains a matter of speculation.

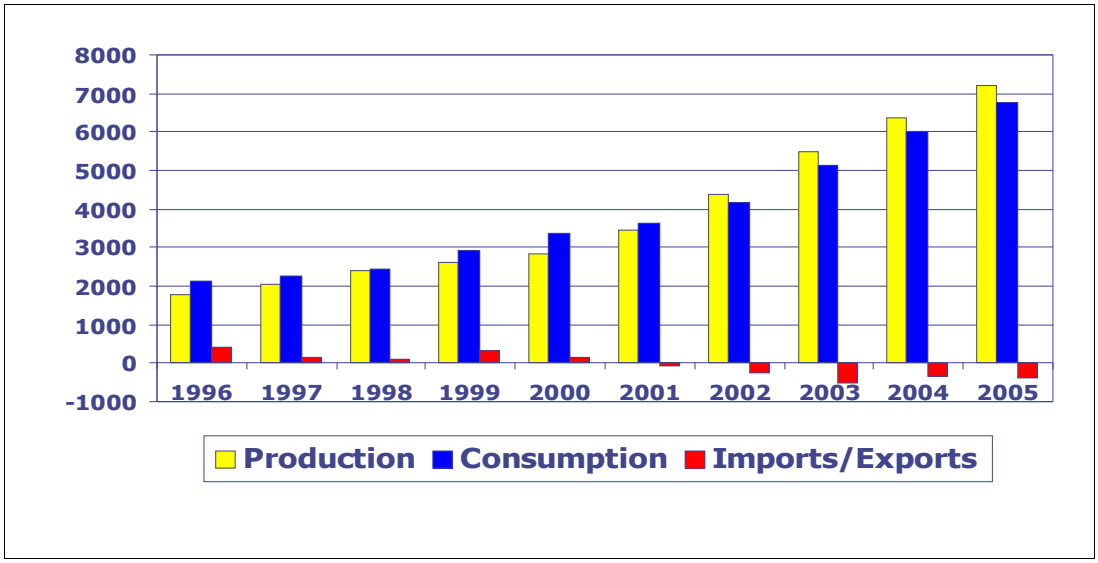
China

China is the world's second largest consumer of aluminium, having recently overtaken a stagnating Japan, and in 2001 it displaced the US as the largest producer. In stark contrast to the FSU, Chinese consumption expanded strongly from a rather low base over the past decade or so. In 1990 the country consumed 860,000 t, about two-thirds as much as Germany.

This was sufficient to make it the world's fourth-largest consuming country, on a per-capita basis its consumption of metal was very low. This of course is still the case, albeit less so, but in volume terms consumption soared during the 1990s such that by 2000 it exceeded 3.3 Mt. In 2003 it expanded to over 5.1 Mt.

Production, too, rose strongly throughout the 1990s but, as the figure indicates, it struggled to match demand, with the result that the country was a net importer of metal throughout the decade. However, this situation has since changed and China has become a net exporter of metal to the West. In 2003 it exported almost 1.04 Mt, an increase of 67.2% from 2001, and imported 545,000 t, up 101.4%, making it a net exporter of 493,000 t. Although we expect demand to continue to grow strongly, the plethora of expansions and greenfield smelter projects currently under construction should ensure that the country continues to produce in excess of its domestic requirements in the near term.

Chinese production and consumption of primary aluminium ('000 t)



Unlike the former Soviet Union (FSU), where production is mainly concentrated in a small number of very large smelters, the Chinese industry is extremely fragmented. By Western (or FSU) standards there are currently no large smelters in China, and the majority of its output still comes from a myriad of small or very small plants scattered around the country. Only six smelters individually produced over 200,000 t in 2003, and just 10 others produced over 100,000 t. Until fairly recently it was very difficult to obtain information about the majority of the Chinese smelters, or have much confidence in that which was forthcoming. However, the flow of information has improved markedly of late and we are now able to construct a more accurate picture of what is happening in the sector, although keeping track of progress at the plethora of new smelter projects and expansions is an almost

impossible task. Table 7 is a snapshot of developments at some of the country's major smelters, with estimates of cumulative output elsewhere.

Antaike, the state-sponsored research organisation, recently noted that the issue of power shortages is likely to result in an increase in joint ventures between domestic aluminium smelters and power companies. A number of producers already have links with power companies or have their own power plants, and more producers are expected to pursue the possibility of this. There have also been a number of examples of power companies entering the aluminium market:

- Qunghai Qiaotou Aluminium and Electricity Co completed the first 50,000 t/y phase of its planned 150,000 t/y greenfield smelter, which it intends to complete by the end of 2004.

- Datun Gas and Power in Jiangsu Province has a 100,000 t/y smelter project scheduled for completion towards the end of 2005.

- The Zhengzhou Longxiang Aluminium Power Co, formed in January by the merging of Longxiang Aluminium Works and Wulong Power Co, is in the process of raising capacity from 55,000 t/y to 150,000 t/y at its smelter in Henan Province.

- Also in Henan, the Huanghe Aluminium and Power Group is expanding capacity from 55,000 t/y to 125,000 t/y by the end of this year.

- Plans by the Henan Shen Huo Industry & Electricity Power Co to build a new smelter have been given a boost by a pledge from its parent company to supply it with cheap power. The company is constructing a 140,000 t/y potline in Yoncheng, which it says will be completed by the end of 2004.

Despite the fact that a number of projects have been delayed by power constraints, high spot alumina prices and problems of obtaining finance, there is no doubt that Chinese smelting capacity will continue to rise strongly over the next few years. No doubt many will fail to meet the over-ambitious deadlines that they have set themselves, but there are sufficient in which we have confidence to guarantee a substantial increase in production over the next few years.

Bauxite and Alumina

In 2003 China produced 10.1 Mt of bauxite, almost all of it from mines owned and operated by Chalco. All of this material was consumed in the company's refineries, and it also imported 618,000 t of bauxite, an increase of 53.3% from the previous year.

China is the world's second-largest producer of alumina (and its largest consumer), with production of metallurgical-grade alumina exceeding 6 Mt in

2003. That places it far behind Australia, which produced 12.8 Mt, but ahead of the US in third place, which produced 4.8 Mt.

During the early 1990s, Chinese alumina refineries operated at very low utilisation rates, reflecting technical difficulties associated with the type of production processes prevalent which, in turn, was dictated by the poor characteristics of Chinese bauxite and limited domestic supplies of higher-quality feed. Bauxite reserves are extensive, totalling in excess of 2,000 Mt of recoverable alumina in some 200 outcrops. However, the vast majority of deposits are composed predominantly of diaspore, and possess high silica to alumina ratios.

These ore characteristics (poor by Western standards) have necessitated the development of relatively complex and energy-intensive hybrid processing routes. Most Chinese refineries use a combined Bayer-sinter (BSP) process although lime-sintering (LS) processing is also used at the Great Wall and Shandong refineries. The most modern plant (Pingguo) does utilise a high temperature pure Bayer process originally developed by Pechiney to process diasporic Greek bauxite.

Chalco has invested substantial sums in raising capacity at its six refineries in recent years. In 2003 they produced just over 6.0 Mt between them, an increase of 11.4% from 2002. All refineries recorded increases, most notably Pingguo where output rose by 56.6%. The company announced that it will produce 6.5 Mt of alumina in 2004, up from 6.05 Mt in 2003, and further noted that it intended to increase capital expenditure to 10.5 billion yuan in 2004 year and 10 billion yuan in 2005, from 5.3 billion yuan in 2003. The increase will largely go towards raising alumina capacity to 8.5 Mt/y in 2005, in order to meet a growing shortage. Chalco expects China's alumina demand to reach 12.8 Mt in 2004, which will require 6.3 Mt of imports compared with 5.6 Mt in 2003. (Table 8)

Higher alumina production has failed to match the requirements of the smelting sector, necessitating the import of increasing volumes of alumina. Despite the strong growth in domestic alumina production during the second half of the 1990s, by the end of the decade the gap between domestic requirements and supply had widened, resulting in an increasing proportion being sourced offshore. This trend has been maintained thus far in the present decade and in 2003 imports reached a record 5.6 Mt.

Chinese monthly alumina imports ('000 t)

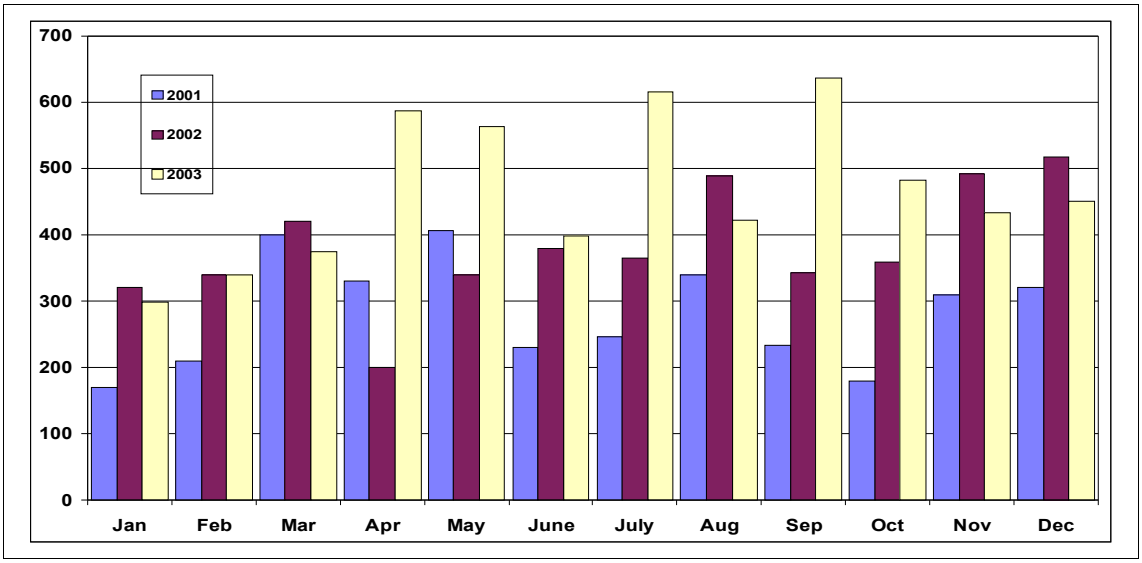


Table 1 Western world bauxite output by major producing countries ('000 t)

Country	1980	1990	2000	2001	2002	2003
Australia	27.2	40.7	53.8	53.3	53.1	55.6
Brazil	4.2	9.9	14.4	13.4	13.1	17.7
Guinea	13.9	16.2	18.0	17.3	17.5	16.4
Jamaica	12.0	10.9	11.1	12.4	13.1	13.1
India	1.8	5.3	7.6	7.9	9.6	9.4
Venezuela	-	3.3	4.4	4.6	5.2	5.4
Others	22.1	12.8	11.9	12.0	13.1	13.8
Totals	**81.2**	**99.1**	**121.2**	**120.9**	**124.7**	**131.4**

Table 2 Western world alumina output by major producing countries ('000 t)

Country	1980	1990	2000	2001	2002	2003
Australia	7.2	11.2	15.7	16.3	16.4	16.8
USA	6.8	5.4	4.3	4.2	4.3	4.8
Brazil	0.5	1.7	3.8	3.5	3.9	4.7
Jamaica	2.4	2.9	3.6	3.5	3.6	3.8
India	0.5	1.3	2.1	2.1	2.7	2.9
Surinam	1.4	1.5	1.9	1.9	1.9	2.0
Others	10.3	10.5	11.1	11.3	10.9	11.3
Totals	**29.1**	**34.5**	**42.5**	**42.8**	**43.7**	**46.3**

Table 3 Brazilian aluminium production by smelter ('000 t)

Company	Smelter	2002	2003	Change
Alcan Aluminio	Aratu	52.4	56.3	+7.4%
	Saramenha	49.6	50.2	+1.2%
Alcoa Aluminio	Pocos de Caldas	88.1	94.9	+7.7%
Albras	Belem	416.1	435.9	+4.8%
Alumar	San Luis	370.5	334.9	-10.4%
CBA	Sorocaba	248.8	313.8	+26.1%
Valesul	Sepitiba Bay	92.9	94.6	+1.8%
Total		**1,318.4**	**1,380.6**	**+4.7%**

Source: Brazilian Aluminium Association

Table 4 Status of smelters in the Pacific Northwest of the US

Company	Plant	Capacity ('000 t/y)	
Alcoa	Wenatchee	215	Completely closed. No plans to restart in near future.
	Troutdale	121	Plant being dismantled.
Intalco (Alcoa 61%)	Ferndale	282	Company reduced operating rate to 90,000 t/y on November 1, 2003.
Columbia Falls	Columbia Falls	170	One of five potlines operating.Take-or-pay contract expired last September.
Golden Northwest	Goldendale	168	Company trying to negotiate suspension of take-or-pay power contract.
	The Dalles	83	Ditto.
Kaiser	Mead	212	Indefinitely closed.
Port of Tacoma	Tacoma	73	To be demolished.
Michigan Avenue Partners	Longview	204	BPA has terminated power contract. Little prospect of reopening in the foreseeable future.
Vanalco	Vancouver	116	Completely idled since February 2001.
	Total	**1,656**	

Source: Various press reports and company data

Table 5 Aluminium smelter production in the FSU ('000 t)

Smelter	Start-up	2001	2002	2003	2004(f)
Bratsk	1966	915	916	931	945
Krasnoyarsk	1964	856	865	903	915
Sayansk	1985	407	414	459	475
Novokusnetsk	1943	282	288	296	305
Irkutsk	1962	272	276	282	285
Uralsk	1939	85	92	103	120
Bogoslovsk	1945	175	183	183	190
Kandalaksha	1951	70	71	71	100
Nadvoitsky	1954	72	74	76	76
Volgograd	1959	145	148	151	151
Volkhov	1932	22	22	23	24
Tayshet	2003	0	0	5	11
Total Russia		**3,301**	**3,349**	**3,483**	**3,598**
Azerbaijan	1955	0	0	19	30
Tadik	1975	290	309	320	348
Zaporozhye	1933	106	106	107	108
Total CIS		**3,697**	**3,764**	**3,929**	**4,084**

Sources: Company data, Pru-Bache forecasts

Table 6 Alumina production in the FSU ('000 t)

	Plant	Start-up	2001	2002	2003
Russia					
	Uralsk	1939	650	679	714
	Bogoslovsk	1943	1,050	1,064	1,078
	Volkhov	1950	0	0	0
	Pikalevo	1959	260	246	249
	Bauxitogorsk	1952	160	38	47
	Achinsk	1973	965	1,035	1,052
	Total Russia		**3,085**	**3,062**	**3,140**
Ukraine	Nikolaev	1980	1,120	1,126	1,198
	Zaporozhye	1956	224	225	250
	Total Ukraine		**1,344**	**1,351**	**1,448**
Kazakhstan	Pavlodar	1964	1,220	1,416	1,450
Azerbiajan	Ghyandia	1966	100	100	200
	Total FSU		**5,749**	**5,929**	**6,238**

Table 7 Aluminium Smelter Production in China ('000 t)					
Smelter	**2000**	**2001**	**2002**	**2003**	**2004(f)**
Guizhou	238	242	238	233	320
Qinghai	206	208	246	269	285
Pingguo	129	134	137	139	140
Shandong	53	55	60	45	60
Zhenghou	45	45	56	56	56
Total	**671**	**684**	**737**	**742**	**861**
Chalco					
Baotou	118	119	136	200	225
Quintongxia	105	145	237	242	400
Lanzhou	86	88	92	139	200
Shangdian	40	43	110	113	225
Wanfan	43	111	111	163	200
Guanlu	50	110	107	107	250
Others	1,718	2,135	2,852	3,784	3,889
Totals	**2,831**	**3,435**	**4,382**	**5,490**	**6,250**

Table 8 Chinese refinery output 2000 – 2003('000 t)							
Refinery	**2000**	**2001**	**2000**	**2001**	**2002**	**2003**	**Change 2002/03**
Shanxi	1,249	1,318	1,249	1,318	1,367	1,416	+3.6%
Zhengzhou	965	1,070	965	1,070	1,270	1,375	+8.3%
Shandong	733	802	733	802	850	930	+9.4%
Zhongzhou	442	545	442	545	800	851	+6.3%
Guizhou	480	519	480	519	673	752	+11.7%
Pingguo	420	443	420	443	440	689	+56.6%
Totals	**4,289**	**4,697**	**4,289**	**4,697**	**5,400**	**6,013**	**+11.4%**