

NICKEL

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Economic activity was strong in 2000 especially during the first half of the year. GDP growth in the US was 5% and industrial production (IP) slightly higher. However, during the year it became apparent that activity was slowing and by the end of the year, growth in GDP had decreased to an annualised rate of around 2%. Performance of the European economies improved during 2000. For example, Germany's GDP was up 3% and IP 5%; in France GDP was up 3% and IP 4%; in Italy GDP was up 3% and IP 5%. The UK cycle more closely followed that of the US with GDP up 3% and IP 2%. The structural problems inherent in Japan's business culture persisted during 2000, and GDP growth of 2% and IP of 5%, while appearing reasonable, continued to disappoint as they were from a low base. Growth in the rest of Asia was quite good. Overall, it was a sound economic background for a reasonable nickel demand.

Western World stainless-steel slab production increased 9% in 2000 to a record 18.8 Mt. – an appropriate level for stainless-steel. There was evidence of inventory building in the first half of the year because of high prices of stainless-steel and this was only partially reversed in the second half. Stainless-steel scrap supplies (especially from Russia) increased sharply and consequently Western primary nickel demand did not increase in line with the 9% increase in stainless production but by a more modest 3% to 1,025,000 t. There was a small decline in Russian primary nickel exports resulting in a market deficit in 2000 for the second consecutive year. Stocks of nickel on the LME finished the year at a low level. Table 1 summaries the supply/demand balance for the past four years.

Nickel Uses

Stainless steel accounts for two-thirds of nickel use, a proportion that is rising because of the rapid growth of stainless compared with other nickel uses. Consumption of stainless steel has done very well throughout the 1990s growing at an average annual rate in excess of 5% - a rate many industry analysts believe is sustainable long term. As stainless-steel prices and alloy surcharges increased during the first half of 2000, consumers and service centres began to purchase ahead of anticipated price increases and inevitably built stocks. When nickel and ferrochrome prices started to weaken around the middle of 2000, the extent of stainless overstocking became apparent. There was a sharp reversal in the market: service centres and fabricators reduced purchases and stainless mills order books declined. This was especially evident in the US where stainless production was reduced severely in the fourth quarter.

There were regional variations in nickel consumption during 2000 influenced mainly by the production of stainless steel and by the availability of scrap. For example, in Europe, although stainless production increased by 8% in the year 2000, primary nickel use increased by only 3%, reflecting the larger quantities of stainless scrap exported from

Supply/Demand Balance for Primary Nickel ('000 t)			
	1998	1999	2000
Western World Demand	940	1,000	1,025
Western Production	720	710	770
Net Eastern Exports + DLA ¹	235	240	220
Western Supply	955	950	990
Market Balance	+15	-50	-35
Stock level year end thereof:	159	132	100
Producer (global)	93	90	90
LME	66	47	10

¹ US Defense Logistics Agency Stockpile

Russia. Stainless production in Asia increased by approximately 14% but so did the use of scrap – surprising for a region that traditionally has been a low scrap user. The biggest increase in primary nickel use was in Japan where stainless production recovered sharply after two years of production cutbacks.

Nickel base alloys, the second largest use of nickel, continued to perform well during 2000. Demand for land-based gas turbines was again very strong as construction of power plants continued worldwide. The rechargeable battery market has been a very strong growth application for nickel although a slowdown was evident in 2000 and early 2001. Nickel metal hydride (NiMH) batteries have grown rapidly since their introduction in 1993. Growth in this market is driven both by new applications and substitution for nickel cadmium (NiCad) batteries. The high performance of NiMH batteries has helped promote the development of smaller and lighter mobile phones and laptop computers. The commercialisation of hybrid vehicles, eg the Toyota Prius, is now established but volumes are still modest. Typically these vehicles run on gasoline engines at above 50 kph while at lower urban speeds they run on electric motors powered by NiMH batteries. Growth in other nickel applications - alloy steels, castings, copper-based alloys and plating - tends to be in line with, or somewhat lower than, economic growth.

Stainless-Steel Scrap

The influence of recycled nickel – including its biggest component, stainless steel scrap – on the primary nickel market is so large that some comment on this form of nickel is appropriate. As nickel in scrap is almost always cheaper than primary nickel it is usual practice for stainless steel producers to buy as much scrap as practical and to use primary nickel as the balancing item to make up their total nickel requirement. It is not uncommon for some stainless producers to derive 70% to 80% of their total nickel from stainless-steel scrap. Of this scrap, a small

Stainless Steel Production ('000 t ingots and slabs)			
	1998	1999	2000
W. Europe	7,150	7,400	8,000
Japan	3,450	3,400	3,800
US	2,000	2,200	2,200
Other	3,650	4,200	4,800
Total	16,250	17,200	18,800

Source: World Stainless Steel Statistics and Abacus estimates

portion is run-around or home scrap within the steel mill, but a large portion is purchased from scrap companies.

When the nickel price rose above US\$4/lb in early 2000 there was a large incentive to dismantle plant in order to release their nickel-containing components and convert them into money. This practice was particularly prevalent in Russia where, attracted by high nickel prices, plant and equipment were dismantled and their metal components exported to Europe.

The sustainability of a high level of exports of stainless-steel scrap from Russia is one of the big uncertainties in the nickel market. On the one hand, it can be argued that, because the reservoir of industrial equipment in Russia is being depleted faster than it is being replaced, the export potential for stainless scrap from Russia will decrease. On the other hand, the actual results show that last year's export of nickel-containing stainless scrap from Russia went against the trend and increased by 40% to 307,000 t – see figure 1.

The difference between what was expected (a decrease in exports) and what actually happened (an increase in exports) supports the position that a component of stainless scrap, namely old scrap, is price sensitive. Figure 1 shows that during 2000 – a year of high nickel prices, especially during the first half – nickel-containing stainless scrap was attracted onto the market while non-nickel containing stainless scrap was not.

Primary Nickel Use ('000 t)			
	1998	1999	2000
W Europe	415	390	400
Japan	170	185	200
US	155	150	150
Other	205	275	275
Total	940	1,000	1,025

Source: INSG

This information also suggested to the Russian Government that equipment is being scrapped prematurely, ie before its natural obsolescence. The possibility that scrap metal exports were increasing because parts of plants were being stolen prompted the government to try to stop this alleged practice by introducing a partial ban on exports of scrap

In February 2001 the Russian Customs announced a ban on the export of ferrous and non-ferrous scrap in trucks or by rail through any border point and via any of the Baltic ports. The ban was implemented on March 2, 2001.

However, it is important to recognise that the Russian Government did not introduce a total ban on scrap exports but rather a mechanism that will encourage domestic metal producers to use scrap, and direct scrap exports through established channels. It should also be recognised that Saint Petersburg is not a Baltic port – it is on the Gulf of Finland – so an increasing proportion of stainless scrap could be routed to Europe via Saint Petersburg.

Mine Production

Nickel occurs in either sulphide or oxide (laterite) ores and current production is split fairly evenly between the two. Sulphides may have copper, cobalt and platinum group metals as by-products whereas laterites will usually only have cobalt and, if the processing route is to ferronickel, the cobalt will not be recovered. Laterite mines are open pit whereas most sulphide mines are underground. There are yield losses between mine production and smelter/refinery

production, typically 10-15%, but with wide variations from plant to plant.

Trade in Ore and Intermediates

The nickel industry is more vertically integrated than most other base-metal industries so there is not a large trade in intermediates for custom smelting. However,

Mine Production of Nickel ('000 t)			
	1998	1999	2000
Africa	73	73	66
Botswana	25	26	24
S. Africa	36	36	34
Zimbabwe	12	11	8
America	297	290	315
Brazil	33	40	35
Canada	208	186	190
Colombia	31	39	60
Dominican Rep.	25	25	28
Venezuela			2
Asia	92	103	120
Indonesia	74	89	100
Philippines	18	14	20
Europe	31	22	29
Finland	2	1	4
Greece	18	16	22
Norway	3	3	3
Yugoslavia (former)	8	2	0
Oceania	268	236	295
Australia	143	126	168
New Caledonia	125	110	127
Western World	761	724	825
China	44	50	50
Russian Federation	235	235	235
Kazakhstan	4	-	-
Cuba	68	67	75
East	351	352	360
World Total	1,112	1,076	1,185

Source: INSG

the recognition that a refinery's unit costs can be reduced by increasing throughput has led to an increase in trade in nickel intermediates.

There is no mine production of nickel in Japan but nickel-containing ore and matte is exported from Indonesia and the Philippines to Japan for upgrading. In Europe, only Greece is a significant integrated producer of nickel so Europe as a whole is a net importer of nickel raw materials. In Africa, mine production exceeds refinery capacity, and matte (a nickel/sulphur intermediary product) from Botswana is shipped to Falconbridge's refinery in Norway for production of electro-refined nickel.

Matte is shipped from Canada to Falconbridge's refinery at Kristiansand in Norway and to Inco's refinery at Clydach in the UK for refining. Intermediates are imported into Canada from Cuba for refining at Sherritt's refinery in Saskatchewan.

Australia is an importer of limonite ore from New Caledonia for the QNI refinery in Queensland but an exporter of sulphide concentrates and matte. New Caledonia exports matte to France for refining and exports substantial quantities of ore, both saprolite to Japan for smelting into ferronickel and limonite to QNI.

Refined Production

Production of nickel in South Africa is a by-product of mining the platinum group metals. Nickel production by Impala in 2000 is estimated at around 11,000 t, of which approximately 7,000 t originated from the company's own mines and the balance was purchased. Rustenburg produced at near the refinery's capacity of some 21,000 t. Total refined nickel production in Zimbabwe was reported as 13,000 t; of which Rio Tinto's Empress refinery produced 6,900 t and Anglo American's Bindura refinery produced around 6,000 t. The Hartley platinum project owned by BHP/Sutton Resources closed in 1999.

In Brazil, Companhia Niquel Tocantins, part of the Votorantim group, uses the Caron ammonia leach process followed by electrowinning, and produced 16,800 t – slightly up on the previous year. Production by Brazil's ferronickel producer, Codemin,

Production of Primary Nickel ('000 t)			
	1998	1999	2000
Africa	51	50	45
S. Africa	35	33	32
Zimbabwe	16	17	13
America	225	200	215
Brazil	21	23	24
Canada	147	124	135
Colombia	28	28	28
Dominican Rep.	25	25	28
US	4	-	-
Asia	135	145	170
Indonesia	8	10	10
Japan	127	135	160
Europe	190	195	185
Austria	2	2	2
Finland	46	55	55
France	12	12	13
Greece	15	13	18
Norway	70	74	59
UK	39	38	38
Yugoslavia (former)	6	1	-
Oceania	125	130	155
Australia	80	85	112
New Caledonia	45	45	43
Western World	726	720	770
China	41	45	50
Russian Federation	227	228	220
Cuba	39	36	40
East	307	309	310
World Total	1,033	1,029	1,080

Source: INSG

increased to 6,800 t from 6,500 t. The other nickel producer in Brazil, Fortaleza, ships smelter matte to Finland where it is refined by OMG.

In Canada, Sherritt's nickel production in 2000 was again at the refinery's nameplate capacity of 28,000 t. Sherritt has a 50/50 joint venture with Moa in Cuba from where nickel cobalt sulphides are supplied for refining. Moa uses a pressure acid leach plant and has been producing for almost 40 years.

The balance of Canadian refined nickel production of 107,000 t came from the Ontario and Manitoba operations of Inco. Inco reported its nickel production in 2000 as 203,000 t of which 59,000 t was nickel in matte from PT Inco in Indonesia and the balance of 144,000 t from its Canadian/UK operations. Refined nickel production in the UK of 38,000 t in 2000, unchanged from the previous year, is all from Inco's plant at Clydach in Wales, refined from intermediates shipped from Sudbury. Inco also produces refined nickel from intermediates and purchased feed in joint ventures in Taiwan and South Korea, but this output is included in the Canadian production figure.

Cerro Matoso in Colombia produced 28,000 t in the form of ferronickel – about the same as in the previous year. Cerro Matoso is owned by the Billiton Group and in January 2001 started up a second line, which will increase capacity from 30,000 t/y to 55,000 t/y.

In the Dominican Republic, Falcondo produced 27,000 t nickel in ferronickel up from 24,500 t in 1999 when the plant was closed in the early part of the year due to adverse market conditions.

There was some mine production reported by Anglo American Corp.'s new operation, Loma de Niquel, in Venezuela but refined production did not start until early 2001.

Aneka Tambang in Indonesia produced 10,000 t nickel in the form of ferronickel. PT

Inco at Soroako on the Indonesian island of Sulawesi produced 59,000 t of nickel in intermediate matte, a 30% increase on the previous year. PT Inco expanded the plant from 45,000 t to 68,000 t, with an associated expansion of the hydroelectric plant, and ramp up began in the third quarter 1999. The majority of PT Inco's production (80%) is shipped to the Tokyo Nickel Co. for refining into class 2 products such as Tonimet, and the balance of 20% to Sumitomo's Niihama electro-winning refinery in Japan.

In Japan, nickel production increased by 25,000 t to 160,000 t of which 74,000 t was in the form of ferronickel, 36,000 t as metal and the balance of 50,000 t as Tonimet/oxide and nickel chemicals. There are three ferronickel producers in Japan: Pacific Metals (Pamco), Sumitomo and Nippon Yakin. In 2000 (1999), Pamco produced around 43,000 t (41,000 t), Sumitomo at Hyuga produced 19,000 t (17,000 t) while Nippon Yakin produced 12,000 t (9,000 t). The higher production reflected better market conditions, namely, increased domestic stainless production and higher nickel prices. Nippon Yakin's ferronickel is all for its own stainless plant. Capacity and production at Sumitomo's Niihama electrowinning nickel refinery was increased to 36,000 t as a result of increased feed from PT Inco's expanded capacity in Indonesia. Sumitomo has a 20% equity stake in the project and off-take rights for matte for 20% of production. Matte is also supplied from WMC's Kalgoorlie smelter in Western Australia. The balance of PT Inco's matte production is sent mainly to the Tokyo Nickel Co., where Inco is the largest shareholder.

OMG's production of nickel briquettes, cathodes and chemicals in Finland increased to 55,000 t. Mine production in Finland increased to 3,600 t from only 700 t in 1999. Most of the feed to the Harjavalta refinery and the Kokkola chemicals plant is in the form of matte from the Fortaleza plant in Brazil or nickel sulphide concentrates or matte from Western Australia. In March 2000, OMG purchased the Harjavalta nickel refinery from Outokumpu.

Cathode and chemicals production by SLN at Sandouville in France was 12-13,000 t in 2000, in line with the previous year.

Larco, the state-owned producer in Greece, increased production of ferronickel to 18,000 t in 2000 from 13,000 t the previous year when furnaces had been closed in response to poor market conditions.

Production in 2000 from Inco's Clydach refinery in Wales, part of which is in the form of carbonyl powder, was unchanged at 38,000 t.

Falconbridge's operations in Sudbury went on strike for 6 months from 1 August 2000 and so was unable to process inputs from its Sudbury ores or from its Raglan mine in Quebec. As a consequence of the strike, output of refined nickel from its refinery at Kristiansand in Norway decreased by 20% to 59,000 t processed from matte supplied from the BCL smelter in Botswana and from other purchased materials.

Until a few years ago there were two main producers of refined nickel products in Australia, namely, WMC producing briquettes and powder (as well as intermediates) in Western Australia and QNI producing nickel compacts in Queensland. In 2000 there were three additional nickel producers all using a pressure acid leach (PAL) technique. Australian production in 2000 was reported as 112,000 t, up 30% from the 85,000 t produced in 1999 – most of the increase came from the PAL plants. Approximate production by producer is estimated as follows: WMC 60,000 t, QNI 26,000 t, Anaconda 14,000 t, Cawse 7,000 t and Bulong 5,000 t.

SLN's production of ferronickel in New Caledonia was slightly down in 2000 at around 43,000 t contained nickel.

The Russian Federation does not release statistics on metal production but market indications suggest that refined nickel

production was 220,000 t slightly down from the previous year's level of 228,000 t.

In China, production of cathodes and chemicals increased 11% to 50,000 t. Cuban production at the old Nicaro plant and the newer Punta Gorda plant increased from 38,700 t to 39,500 t.

A number of nickel projects are currently under review notably: Inco's Goro and Voisey's Bay projects, Billiton's Ravensthorpe and BHP's Gag Island.

Prices

Since 1980 the price has varied from a low of US\$3,175/t to a high of US\$23,901/t, the average nickel price was US\$6,909/t (US\$3.13/lb) and the median nickel price was US\$6,327/t (US\$2.87/lb).

Table 6 shows that Inco's published price generally lags the LME price and also shows a greater degree of stability than LME prices. The absolute Inco price level also differs from the LME price for a number of reasons, eg the Inco data include, as well as LME type products, both higher added value products and intermediate materials for further processing.

The impression, described in the beginning of this review that the year 2000 was a year of

Nickel Prices US\$/lb Average for Period			
		LME Cash	Inco realised
1996		3.40	3.61
1997		3.14	3.36
1998		2.10	2.40
1999		2.73	2.91
2000		3.92	4.09
1999	Q1	2.11	2.35
	Q2	2.37	2.59
	Q3	2.90	3.06
	Q4	3.53	3.68
2000	Q1	4.29	4.24
	Q2	4.27	4.53
	Q3	3.75	3.92
	Q4	3.38	3.60

Source: LME and Inco quarterly reports

two distinct halves was also evident in the price behaviour – high prices during the first half followed by a steep decline in prices during the second half. Not only did the market balance tilt towards greater supply during the second half of the year but the important element of sentiment also swayed from bullish to bearish. Inco's three-year labour contract with its Sudbury workforce expired at the end of May and the market regarded a strike as a distinct possibility, given that the company had a strike at its Manitoba plant the previous year. This expectation had been built into the nickel price until May so when no strike took place

and with demand slowing, the high prices during the first half failed to be maintained. Evidence of the extent of the large scrap supply added further to the pressure on prices. By the first quarter 2001, LME nickel inventories were very low and there were signs that the US slowdown may only be a slowdown and not a recession. By the second quarter 2001, there were signs of rising confidence and nickel prices firmed, helped by an announcement from Norilsk that Russian primary nickel exports would be lower in 2001 and by the Russian Government's partial ban on scrap exports.