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SHORT-, MEDIUM- AND LONG-RANGE TRENDS IN ALUMINIUM SUPPLY/DEMAND*

by

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METHODOLOGY OF FORECASTING

Let me first briefly discuss the methodology of forecasting. I'm sure you all recognize that the demand for aluminum is a derived demand. This demand is dependent upon the macro-economic events which are influenced by government fiscal and monetary policies. In addition, in a market-oriented economy the demand for aluminum may be further enhanced by the increasing or decreasing penetration of the material because of its competitive position against other materials.

In forecasting aluminum demand you should start with a top down approach. First and foremost is what the basic demand trend in the economy is going to be like. Many forecasters then try to segment the aluminum market into various categories - Building and Construction, Transportation, Containers and Packaging, Electrical Applications, etc. Within each of these market categories many forecasters even try to sub-categorize the market classifications, for instance, in the Building and Construction market, how many windows and doors will be made out of aluminum, how many gutters and downspouts will be made, what aluminum siding requirements will be, what amount of architectural products will use aluminum, farm roofing, and so on.

This approach to forecasting is all well and good. However, in making a good industry demand forecast I find it of little use, and it can lead to a great deal of error in model building. Unless one has a very good input-output grid of the economic system with which to work, the cumulative errors one gets from segment analysis usually lead to significant estimating errors of demand, both short and longer term. Segment analysis is of great interest once one

knows the general framework of demand and is primarily the interest of industry marketing experts.

My own particular methodology in forecasting aluminum demand relates to the broad economic developments that influence that demand. In studying an economy, one must first know what the major sector uses of aluminum are. Let me use the United States as an example. In building a model of the aluminum industry, I use the following economic indicators as independent-variable to explain the shipment of aluminum to the economy.

- The index of industrial production - statistically, this helps explain better than 90% of the demand for aluminum.

- Housing starts and mobile home production, home improvement and non-residential building expenditures, with appropriate lags to reflect the requirement of aluminum shipments to these important markets. These particular series are not reflected in the U.S. industrial production series.

- Customer inventory change of aluminum products and inventory and backlog in the economy as a whole.

- Competitive prices of materials, which compete with aluminum, again with appropriate lags to reflect their influence on aluminum's gain or loss in market penetration.

How well the relationship of the independent variables work in explaining and forecasting aluminum demand is shown in Charts A and B. To check the model accuracy in forecasting in Chart A, the quarterly observations actual vs. simulated (1950-1970) have an extremely close correlation with each other. By stopping the model in 1970 and projecting quarterly domestic aluminum developments against the actual independent variables, we are able to compare the model calculations against actual industry shipments through the fourth quarter of 1977.

In forecasting, the more observations one has, the greater the reliability of the model. In Chart B you can again see the quarterly observations of actual U.S. simulated demand from 1958 to 1976 and a projection of quarterly 1977 aluminum shipments against actual results.

Today our domestic aluminum shipment model has an R_2 of 99.7% and a standard error estimate of 2.3 % per quarter. We have similar aluminum demand models in various degrees of sophistication for each of the industrial countries of the world.

All Charts A and B really tell you is that, based on an historical record of results, we can explain 99.7% of the demand for aluminum. To forecast the future, all you need is the correct set of actual independent variables to put into the model to get the right amount of aluminum demand -- which brings me back to my

opening comments, and that is in understanding any set of projections, you must know and understand the forecaster and his economic assumptions and that forecasts are largely guesswork based on various probabilities.

But even to make the guess, you have to understand the macro-economic forces which influence demand within your country.

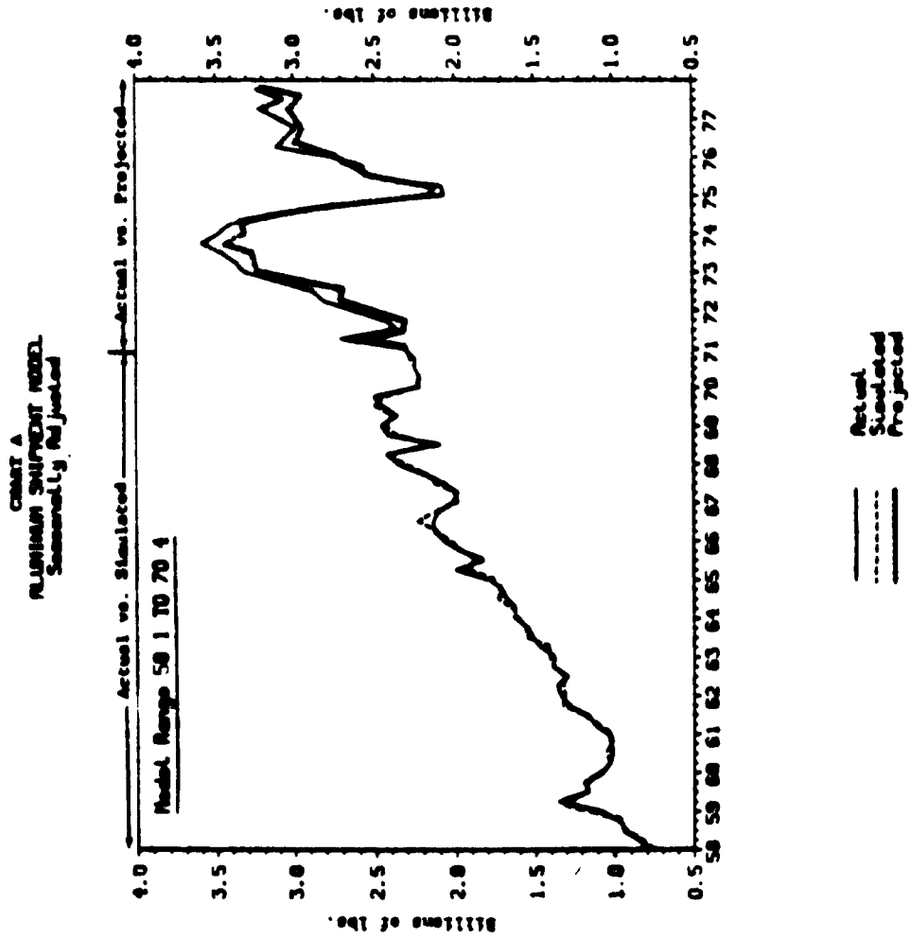
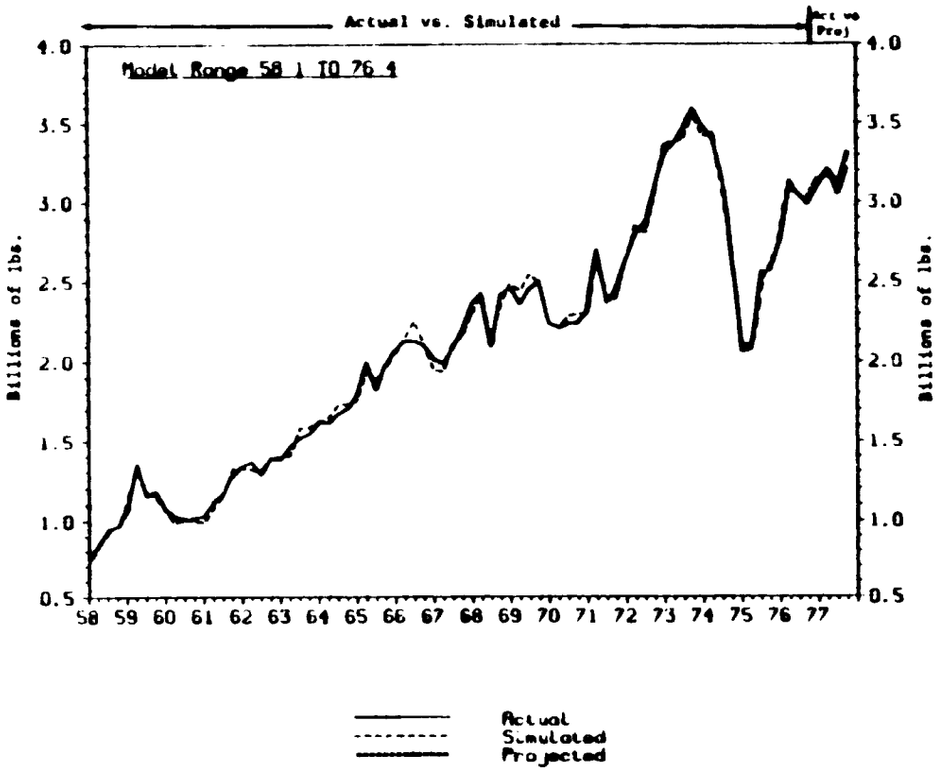


CHART A
PLUTONIUM SNAPSHOT MODEL
Seasonally Adjusted
Actual vs. Simulated
Actual vs. Projected
Model Range 50 1 70 70 4
Billions of lbs.
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
50 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
Actual
Simulated
Projected

CHART B

ALUMINUM SHIPMENT MODEL

Seasonally Adjusted



MEDIUM TERM FORECAST - 1978-1982

I would now like to discuss my medium term forecast of aluminum demand in the Western economies of the world. In developing a five-year forecast of aluminum supply/demand, I doubt it makes much difference whether you're bullish or bearish on the short-term outlook for the economy.

While timing differences might occur, the basic trend operating in the aluminum industry is for a favorable supply/demand environment over the next five years - one which will be conducive to firm pricing, good profits and eventual reinvestment in the expansion of primary smelting capacity. If the industrial economies of the West abort in 1978, causing a recession, primary aluminum will back up into the system, and cause a short-term over-supply. This would only serve to delay future capacity additions now in the planning stages, so that in the next upturn in world economies, new supply would continue to be limited, allowing for a speedy recovery in prices and profitability. Thus, we would again be looking at a favorable supply/demand balance in the aluminum industry.

Aluminum producers around the world continue to approach new smelters expansion with a great deal of caution. The 1976-1977 profit recovery in the industry was built on a fragile base of low confidence in the business outlook and during a period of world monetary turmoil. Thus, the price and profit recovery has not lasted long enough to trigger active capital investment by the industry, though the recovery has lasted long enough for the industry to at least start looking at future expansion alternatives. The process of gearing up for new primary capacity is slow. There is little incremental capacity that can be added to the industry infrastructure, so new capacity has to be built on green-field sites. High energy costs require detailed studies of alternative site selection and environmental impact studies, further stretching out lead time. Because of these considerations, new primary smelter capacity expansions over the next five years will be limited to no more than a 4% per annum increase.

Our own aluminum industry forecast for 1978-1982 is very good and is based on an expanding world economy. We believe the probable duration of the current business cycle will carry us into 1980. The economy could slow down in 1980-1981, with a recovery in business again in 1982. Under this type of economic trend the general framework of aluminum industry supply/demand conditions would be one of limited new supply, rising demand and rising aluminum prices. As the industry gains more confidence in its ability to maintain corporate profitability, it will be encouraged to build new primary capacity for the mid-1980 period.

U.S. INDUSTRY OUTLOOK

The U.S. economy will show strong growth in 1978. Real GNP this year could rise by almost 5% compared with 1977. We further

feel the probable duration of the U.S. business cycle will carry into 1980. For the purpose of constructing our longer term U.S. supply/demand model, we have assumed a modest recession in mid-1980 through mid-1981, followed by an economic recovery in 1982.

Within the context of the above economic forecast, the following U.S. aluminum supply/demand model seems the most probable (see Table I).

ALUMINUM CONSUMPTION - FIVE-YEAR AVERAGE GROWTH RATE 5.3%

- In 1977 aluminum consumption rose by 10% over 1976.
- In 1978 aluminum consumption could rise by another 7.7% to 14.5 billion pounds.
- In 1979 consumption growth could slow, rising by 3.4% to 15.0 billion pounds.
- In 1980, an election year, some economic stimulation could result in consumption rising to 15.7 billion pounds, up 4.7% from 1979.
- In 1981 a projected recession and then recovery could result in almost no gain in aluminum consumed in the economy when compared with 1980.
- In 1982, a business recovery in key consuming markets could boost aluminum consumed by almost 8% from 1982.

CUSTOMER INVENTORY

Throughout the 1978-1982 period, while continuing to follow a cautious policy, customers will have to keep a wary eye on the growing U.S. dependence on imported aluminum. As a result, customers are unlikely to engage in any drastic liquidation of their stocks, which are already at minimum working levels, in our opinion.

- As discussed in detail in our recent monthly reports, we think that if customers are to end 1978 with minimum working levels of inventory, they will be required to add 200 million pounds to their stocks. This is after a 600 million pound drop in their inventories in 1977.
- In 1979 we have assumed that customers may allow their stocks to drift somewhat lower, as the rate of business expansion slows, perhaps by 50 million pounds.
- However, in 1980 we feel customers are likely to add to their stocks again. In the first half of the year they will hedge the upcoming labor talks, as the labor contracts expire on May 31, 1980. Even though the economy may turn down in late 1980, customers will find that domestic smelters will continue to

operate at near capacity rates and the U.S. will still be importing record amounts of aluminium. This continued dependence on imports is not only likely to prevent inventory liquidation but may, in fact, result in customers adding to their stocks to adjust their minimum working levels.

- If by the end of 1981 the economy is again heading up, customers will have to add to inventories to maintain normal working stocks going into 1982-we estimate 80 million pounds.

- Again our model assumes another 125 million pound addition to customers' stocks in 1982, enough to maintain inventories in line with consumption.

DOMESTIC SHIPMENTS

- The combination of growth in consumption and a net inventory swing of 800 million pounds could result in a 14.5% gain in domestic shipments to customers in 1978 versus 1977.

- In 1979 shipments may rise by only 1%-2% because of a slowing in consumption growth and a small reduction in customers' inventory accumulation.

- In 1980 a 4.7% gain in consumption plus a 130 million pound net swing in customer inventories could boost domestic shipments by 5.6% over 1979.

- In 1981 a slowing in demand plus a modest gain in customer inventories could keep shipments essentially flat on a year-to-year basis with 1980.

- In 1982, as demand recovers cyclically, shipments could rise by 8.2% from 1981.

EXPORTS

With a tight domestic market, exports of aluminum are likely to remain flat over the next two years. Exports of can sheet in 1978-1979 are expected to decline as European can sheet capacity rises. This is expected to be offset by the normal growth in the demand for U.S. mill products not normally manufactured in many countries of the world. Ingot exports are expected to be minimal during the 1978-1982 period.

SUPPLIER INVENTORIES TO GROW PROGRESSIVELY TIGHTER

- The industry added 71 million pounds to inventory in 1977 and inventories averaged 5.0 months' supply, the same as in 1976.

- This year we estimate industry stocks could decline by some 527 million pounds, reducing them to approximately a 4.3-month supply by year-end.

- Inventories could be reduced by another 100 million pounds per year in both 1979 and 1980. This would reduce supplier stocks to 4.0 and 3.7 months' supply, respectively. Historically, normal inventories are somewhere between 4.0 and 4.5 months' supply.

- In 1981 we have assumed industry inventories remain unchanged. However, in 1982 the industry will add a minimum of 100 million pounds to inventory. Even with that, inventories would decline by a 3.5 months' supply, a level not experienced since early 1974.

PRIMARY ALUMINUM PRODUCTION

- Last year primary aluminum production was equal to 84.5% of capacity. During the year, production was restricted by energy shortages in the Northwest, after starting the year out operating at 89% of capacity.

- In 1978, with better availability of energy even though there will be some losses due to the coal strike, primary production is likely to approximate 93.3% of capacity.

- Next year primary production could approximate 94% of capacity. This assumes that all smelters, except the two Texas plants using natural gas for energy and owned by Alcoa and Reynolds, will remain shut down. We think both of these plants could remain down until about 1982, or unless the price of ingot rises sufficiently to justify starting up these high-cost operations. By 1982, both of these plants could begin receiving energy from coal-fired plants now being considered in the region.

- Primary aluminum production in 1980 and 1981 should be effective capacity less the two Texas plants.

- The five-year production forecast assumes no shortages of energy, which could prove to be too optimistic based on the experience of the last several years.

IMPORTS - THE BALANCING FACTOR

- If the U.S. economy is to meet its future needs for aluminum, it is going to become more dependent upon imported metal, both primary and mill shapes.

- Imports in 1977 rose to 1,505 million pounds, up from 1,341 million pounds in 1976.

- In 1978 import requirements are likely to rise to approximately 1.8 billion pounds.

- In 1979 and 1980 imports could rise to 2.1 billion and 2.3 billion pounds, respectively. Even in 1981, which could be a flat year in demand, import requirements will have to approximate 2.3 billion pounds.

- In 1982, imported aluminum requirements may have to rise to just over 2.6 billion pounds to balance out supply/demand.

- The import needs of the U.S. economy should be easily met by overseas suppliers through 1979. However, after that time, U.S. consumers will have to compete with overseas users of aluminum for the available supply of materials.

- The U.S. dependency on higher cost overseas imports also provides the domestic aluminum industry with some cushion if future demand is not as strong as projected.

SECONDARY RECOVERY

- Secondary recovery of aluminum in 1977 was approximately 21.6% of industry shipments. By 1982 we estimate recovery may rise to 22.7% of shipments as a result of better recycling efforts by industry and customers.

TABLE I

Estimated U.S. Aluminum Demand/Supply Balance
(Millions of Pounds)

	1977	1978	1979	1980	1981	1982
Demand						
Consumption	13,463	14,500	15,000	15,700	15,750	17,000
Customer Inventory Change	(617)	205	(80)	50	80	125
Shipments - Domestic	12,846	14,705	14,920	15,750	15,830	17,125
- Exports	726	575	575	600	600	625
Metal Losses	206	525	525	550	555	600
Total Metal Requirement	13,778	15,805	16,020	16,900	16,985	18,350
Supply System Inventory Change	71	(527)	(100)	(100)	-	100
Total New Supply	13,849	15,278	15,920	16,800	17,240	18,450
Primary Aluminum Production	9,077	9,818	10,000	10,450	10,640	11,350
Imports - Primary	1,340	1,560	1,850	2,000	2,200	2,360
- Mill Products	165	240	250	265	265	275
Secondary Recovery	2,936	3,300	3,445	3,690	3,735	4,035
Estimated Alloys Added	331	360	375	395	400	430
Shipments						
Net Shipments	13,190	14,760	14,945	15,770	15,855	17,130
Net Imports Mill Products	155	225	245	260	260	270
Unreported Secondary	227	295	305	320	315	350
Total	13,572	15,280	15,495	16,350	16,430	17,750
Average Months Supply	5.0	4.4	4.0	3.7	3.7	3.5
Primary Aluminum Operating Rate	84.5%	93.2%	94.0%	95.8%	95.8%	99.0%

Source: The Spector Report Estimates 1978-1982

WORLD PRIMARY ALUMINUM PRODUCTION

Primary aluminum production by region is shown in Table II.

- In the U.S., as explained, primary production in 1977 was equal to 84.5% of capacity and the operating rate is projected to rise to 93.2% in 1978.

- In Canada production last year was 977,000 tons, or 92.7% of capacity, restricted in part because Alcan Aluminium was still recovering from a six-month strike. This year we estimate the Canadian production rate a 97.7% of capacity.

- Primary aluminum production in Latin America in 1977 was 358,000 tons, or 68.7% of average capacity. Production was limited because of energy restrictions in Argentina and Surinam. Also, toward year-end Venezuelan capacity was completed but not energized. This year we are estimating primary production at 472,000 tons for the region, or 67.2% of average capacity, based on the same factors that limited production in 1977. In Argentina, aluminum production has also been cut back in the first half of 1978 because of poor demand.

- European smelter production in 1977 was equal to 94.5% of capacity. This year we estimate it could rise to 97.5% of average capacity.

- Production in Africa last year was 367,000 tons, or 84.8% of capacity. This year we estimate production could rise to 99.3% of capacity.

- Production in South Asia in 1977 was 379,000 tons, or 66.6% of average capacity. Energy shortages in India and Iran were the reasons for the low operation levels. This year with a slightly better energy picture, we are estimating production at 408,000 tons or just under 67% of capacity.

- In East Asia primary smelter output was 1,235,000 tons, or 75.4% of capacity. Production in Japan was limited by poor demand to a 72.4% operating rate, while in Taiwan production was hurt by a typhoon which closed down most of the smelter operations for a time. This year production for the region is likely to approximate 78% of capacity, with Japanese smelter production essentially unchanged on a year-over-year basis.

- Primary smelter output in Oceania was at capacity during 1977 and is expected to remain so in 1978.

TABLE II

World Primary Aluminum Production*
Thousands of Metric Tons

Region	1977	1978E
North America		
Canada	977	1,020
United States	4,116	4,448
Total	5,093	5,468
Latin America		
Argentina	52	52
Brazil	166	191
Mexico	43	44
Surinam	50	50
Venezuela	47	135
Total	358	472
Europe		
Austria	92	92
France	398	398
Greece	129	138
Iceland	72	73
Italy	263	274
Netherland	238	259
Norway	639	695
Spain	204	250
Sweden	82	82
Switzerland	82	89
United Kingdom	349	370
West Germany	744	740
Yougoslavia	199	200
Total	3,491	3,660
Africa		
Egypt	89	100
South Africa	78	79
Cameroon	46	59
Ghana	154	200
Total	367	438
South Asia		
Bahrain	124	124
India	181	185
Iran	23	40
Turkey	51	59
Total	379	408
East Asia		
Japan	1,188	1,190
South Korea	18	18
Taiwan	29	70
Total	1,235	1,278
Oceania		
Australia	241	249
New Zealand	152	152
	393	401
Total World	11,316	12,125
Less U.S.	7,200	7,677

*Excludes - Peoples Republic of China, North Korea and Eastern Europe
Source: Combination of various sources.

TOTAL WORLD DEMAND* - PRIMARY ALUMINUM

World demand for primary aluminum last year was just under 11.3 million tons, up 2.5% from 1976. In the U.S. demand rose by just under 4%, while in non-U.S. markets demand rose by 1.6% in 1977 versus 1976. In most world markets 1977 was characterized by slow economic growth, or recessions in some countries, with the exception of the U.S. The one characteristic of all world markets in 1977 was the tendency for customers to liquidate their inventories, which they built back up in 1976 after the 1974-1975 recessions.

In forecasting non-U.S. world aluminum markets through 1982, we continue to be working on the assumption that industrial world economies will experience several years of real but below normal growth. 1976 and 1977 were adjustment years and in 1978 we believe the key economies of West Germany and Japan will again improve. We think this is now in the process of unfolding at an improving rate over the fourth quarter of 1977 and will become more evident as 1978 progresses. This should further improve the outlook for the rest of the industrialized and developing nations in 1978-1979.

The general forecast on aluminum demand in non-U.S. markets is for the rate of growth to peak in 1979, and slow down through 1980-1981 before accelerating again.

- In Canada, we continue to forecast a sluggish economy for 1978. However, last year, with a poor economy, Canadian primary aluminum demand rose by just under 5%. This year we estimate it could rise another 6.4%. In 1979 and 1980 we project a 10.5% and 10% growth rate, respectively, a slowdown in growth in 1981 to 5.4% and an almost 11% gain in 1982 over 1981.

- In 1977 Latin American aluminum demand rose an estimated 11.4%. This year, with continued growth in Brazil and Venezuela and a recovery in Mexico, regional demand could rise by another 11% or so. Between 1979 and 1982 demand growth could approximate 7%-14% per annum with the low growth year projected in 1981.

- Aluminum demand in Europe in 1977 was down marginally from 1976. This year we are estimating the region could show a 5.6% growth in demand, peaking at a 9% growth rate in 1979 versus 1978. Demand growth is projected to slow down in 1980 to 6.5% and possibly 2.5% in 1981. In 1982, assuming a more stable economic environment, demand could rise again by perhaps 6.5%.

- The Japanese economy in 1978 should show a better tone as the year progresses. Primary aluminum demand last year was down 8.9% from 1976, due mainly to a decline in customers' inventories of primary metal. This year we estimate primary metal demand could rise by 8.1% and by another 10.5% in 1979. At that point, growth could again slow to 8.6% in 1980 and 3.4% in 1981. Assuming a recovery in the 1982 economic performance, aluminum demand that year might rise by 9% to 2.0 million tons.

- Demand in the smaller industrialized and developing countries showed a good rise last year, up 16.0% over 1976. We think demand in these countries will tend to rise at a faster rate than in the more industrialized countries and such demand growth could run 14.0%, 12.5%, 11.1%, 5.3% and 10%, respectively, in 1978 through 1982.

TABLE III

Estimated World Primary Aluminum Demand*
(Thousands of Metric Tons)

	United States	Canada	Latin America	Europe	Japan	Rest of World	Total Ex U.S.	Total World
1974	4,659	419	424	3,156	1,362	920	5,281	10,940
1975	3,220	278	458	2,562	1,087	1,036	5,421	8,641
1976	4,273	385	472	3,224	1,505	1,156	6,742	11,015
1977	4,440	404	526	3,210	1,369	1,341	6,850	11,290
1978	5,030	430	585	3,390	1,480	1,520	7,405	12,435
1979	5,272	475	658	3,700	1,635	1,710	8,178	13,450
1980	5,540	522	735	3,940	1,775	1,900	8,872	14,412
1981	5,670	550	790	4,040	1,835	2,000	9,215	14,885
1982	6,013	600	900	4,300	2,000	2,200	10,000	16,013

Sources: Various national publications· The Spector Report 1977-1982

*Excludes Peoples Republic of China, North Korea and Eastern Europe

NON-U.S. LONG-TERM METAL BALANCE

The long-term tightening of the world aluminum supply can best be seen from studying the statistical metal balance shown in Table IV.

- Demand for aluminum is made up of three elements: 1) non-U.S. regional demand as shown in Table III; 2) the net U.S. import requirement which is necessary to balance the U.S. market; and 3) shipments to the Sino-Soviet Eastern European bloc countries.

- In addition to growth in demand forecasts in the various regional markets, the incremental demand for aluminum on the world scene will come from the U.S. For example, in 1975 the net U.S. demand (imports over exports) was 83,000 tons. Admittedly, this was a recession year, but in 1976 net U.S. demand rose to 239,000 tons and in 1977 to 353,000 tons. This year we estimate that the U.S. net import demand could total 555,000 tons and 692,000 tons in 1979. The ability of non-U.S. smelters to handle this demand through 1979 is considered adequate. In fact, it is this demand that helps balance out the world metal supply. However, beginning in 1980 through 1982, the net U.S. demand will tend to create a metal squeeze so that consumers in the major importing regions -U.S., Europe and Japan-will have to compete in the market for limited supplies.

- Shipments of aluminum to the Sino-Eastern European bloc countries are always highly unpredictable. In 1975, the Peoples Republic of China came into the market heavily and, as a result, shipments to this sector of the market hit a record 422,000 tons. In 1977 shipments dropped to 90,000 tons. Late last year China again was reported to be buying primary metal and this year we estimate that shipments could rise to 200,000 tons. China also indicated that it expects to emphasize modernization of its economy. Since this will likely include major electrification programs and construction projects, both major consuming markets for aluminum products, we have assumed in our projections a 180,000-225,000-ton level of demand through 1982 for China and Eastern Europe.

- The supply components include primary aluminum production and imports of primary metal from Eastern European countries - primary aluminum production in 1977 was just 7,200,000 tons, or 89.1% of capacity. This year, as outlined in Table II, we estimate production at just under 7.7 million tons, or 91% of capacity. In 1979 we estimate that non-U.S. smelter output could rise to 97.4% of effective capacity and run at 100% of capacity from 1980 to 1982.

Within the context of this forecast, Japanese smelters are proposing to mothball 340,000 tons of capacity, if the Ministry of

Industry and Trade approves. This is equal to better than 3.0% of industry non-U.S. smelter capacity. If approved this April, based on our projections, world smelter production in 1978 and 1979 would be operating at a much higher rate of on-line operational capacity. By the same token, the off-line capacity in Japan also suggests that if our demand projections prove to be too optimistic, a 97% production rate of operational capacity would also provide a better balance between supply and demand.

As with our U.S. primary smelter production estimate, we have assumed no energy shortfall or other production problems in the world. Any such difficulties would only serve to squeeze down supply. Eastern European supply of primary metal and fabricated products rose last year to an estimated 317,000 tons from 301,000 in 1976 and 242,000 in 1975. We have projected that this source of aluminum would tend to rise to as much as 400,000 tons by 1982 and would serve to supplement the deficient western world's metal supply.

- Last year inventories of aluminum in the non-U.S. supply system rose by 224,000 tons after a decline of 530,000 tons in 1976. Average months' supply in 1977 was 3.5 versus 3.2 months' in 1976. We estimate that about 2.5 months' supply is considered normal. This year we estimate that inventories could decline by 158,000 tons. In our opinion, a slight upward inventory build will occur in the first half of the year, followed by a sharp decline in producer stocks in the final half of the year. This will reduce the average inventories for 1978 to 2.9 months' supply, less than 15 days above normal. In 1979 and 1980 inventories could be reduced again by smaller amounts, dropping to 2.6 and 2.3 months' supply, suggesting near theoretical balance in supply/demand, with a small shortage implied in 1981. Even in 1981, assuming a modest slowdown in world demand for primary aluminum and a slight buildup in inventories (109,000 tons) inventory could only average 2.3 months' supply.

The real metal squeeze, if it occurs in line with our demand projections, will come in 1982. Based on current expansion programs now under construction or planned for that year, a potential metal squeeze, relative to what the supply system needs to process the suggested demand level, worked out to 455,000 tons or 1.9 months' supply. This only means that the industry will have to operate more efficiently on lower inventory and produce slightly above rated capacity. The only potential difficulties for customers in obtaining metal would be due to the occurrence of strikes, production problems or energy shortages.

We also believe that if the demand pattern develops as projected over the next two years, some additional capacity may be on-stream by 1982.

As we stated in the opening summary of this report, future metal supply is limited. If a recessionary tendency develops in world markets this year or next, a short-term metal squeeze will be postponed. Expansion projects will be delayed and rescheduled until the above ground inventories are reduced. The only potential negative long-term supply scenario we could develop would be if the world aluminum demand expands as projected through 1980-1982 and 1982 proves to be a year of severe recession.

By that time sufficient new smelter expansion may be under construction and coming out of the pipeline just as demand falters. Unless the industry were to cut back production quickly, metal would backup into the supply system. Therefore, in the subsequent economic recovery the industry would not only have to work off its above ground inventories, it would also have to contend with increased capacity additions. This would delay the eventual price and price recovery. In the forecasting business only time will tell.

TABLE IV

Estimated World Primary Aluminum Metal Balance - Excluding the United States*
(Thousands of Metric Tons)

	1975	1976	1977	1978	1979	1980	1981	1982
Demand								
World Excluding U.S.	5,421	6,742	6,850	7,405	8,178	8,872	9,215	10,000
Net U.S. Import Demand	83	239	353	555	692	755	846	912
Sino-Eastern Europe Demand	422	215	90	200	180	200	210	225
Total Demand	5,926	7,196	7,293	8,160	9,050	9,827	10,271	11,137
Supply								
Primary Aluminum Production	6,380	6,365	7,200	7,677	8,675	9,425	10,005	10,455
Eastern European Imports	242	301	317	325	335	375	375	400
Total Primary Ingot Supply	6,622	6,666	7,517	8,002	9,010	9,800	10,380	10,855
Inventory Change (Demand ± Supply)	696	(530)	224	(158)	(40)	(27)	.09	(282)
Ending Inventory	2,424	1,894	2,118	1,960	1,920	1,893	2,002	1,720
Inventory - Months Supply	4.9	3.2	3.5	2.9	2.6	2.3	2.3	1.9
Normal Inventory	1,288	1,410	1,505	1,675	1,840	1,960	2,085	2,175
Inventory Excess or Shortage	1,136	484	613	285	80	(67)	(83)	(455)
Effective Primary Aluminum Capacity	7,550	7,900	8,095	8,445	8,905	9,425	10,005	10,455
Required Operating Balance Rate	69.1%	73.8%	81.7%	87.5%	96.5%	100.7%	100.8%	104.4%
Actual or Estimated Operating Rate	84.5%	80.6%	89.1%	90.9%	97.4%	100.0%	100.0%	100.0%

*Excludes Peoples Republic of China, North Korea and Eastern Europe

Source: The Specter Report

LONG-RANGE FORECASTS

In making a longer term forecast beyond five years, I prefer to talk in generalities rather than provide you with a statistical projection, which in reality is nothing more than an extension of past trends and, in my opinion, is a meaningless exercise. The basic assumption built into any long-term projection is that the world economic environment will provide a climate conclusive to the growth in demand for aluminum. Implicit in this is that economic recession will occur from time to time, the magnitude of which is difficult to predict. As aluminum increases its penetration of the world economy, the more sensitive it becomes to changes in the business climate.

So diverse are the economies of the world that we can make no single generalization which would characterize the potential growth in aluminum. However, an analysis of the various consumption patterns by country indicate that demand for aluminum flourishes best as countries become more highly industrailized and as nations improve the standard of living of their people. This is because aluminum is a consumer-oriented commodity. For this reason, even though some of the lesser developed nations have shown higher growth rates because of a very low starting base, the United States, Japan and Western Europe are the largest single consuming markets in the world. The potential here lies in the comparisons of annual per capita consumption between other areas of the world compared with the industrialized nations.

On a comparative basis, one measure of a nation's economic stature in the world is its annual per capita consumption statistics. For aluminum, this is shown in Table V and indicates the possible room for improvement as countries improve their living standards.

A high growth rate in aluminum demand by the lesser-developed countries of Africa, Asia and Latin America may be expected. However, these gains will be made from a low starting base, in some cases just a few thousand tons. Until there are more major industries that will work toward tonnage markets, total volume will not be very large by individual countries, but in toto add up to a large amount of aluminum. At present, consumer durables (mostly in the form of household utensils) electrical conductors and building industries are the major markets for aluminum in developing countries. These lesser-developed areas undoubtedly have vast economic potential, but often political instability and uncertainty on the part of private investments are problems which must be overcome to take advantage of future growth.

THE FUTURE ROLE AND SHARE OF DEVELOPING COUNTRIES

The future role of developing nations in the world aluminum industry is one key to the growth in demand. From my preceding

TABLE V

Per Capita Aluminum Consumption
Pounds

	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966
Argentina*	6.9	7.8	9.0	6.7	9.7	6.6	5.9	6.0	4.8	3.8	4.4
Australia*	31.0	25.7	33.6*	29.1*	23.4*	24.7*	24.0*	22.6*	20.6*	17.1	15.6
Austria	23.3*	24.4*	20.4*	19.8*	17.9*	16.2*	18.2	13.5	16.7	15.4	10.2
Belgium	25.8	16.5	23.0	21.9	18.1	15.4	13.1	12.9	9.1	7.2	8.6
Brazil*	5.2	4.9	4.8	4.0	3.5	2.9	2.4	2.4	2.1	1.8	1.8
Canada*	30.2	28.4	35.4	33.1	30.6	29.8	25.8	25.5	23.4	21.3	24.3
Finland	na	31.6	22.4	17.5	14.6	13.2	16.7	17.7	12.5	12.5	12.1
France*	26.4	20.3	25.0	24.8	21.6	19.5	19.5	19.5	15.5	14.0	14.5
Germany, West*	42.6	32.2	36.1	38.8	33.7	32.1	30.1	30.3	25.7	19.5	20.5
Greece	na	6.7	8.0	7.0	6.9	7.7	5.9	3.3	3.7	4.4	4.1
Iceland	21.0	15.5*	21.3*	16.0*	38.1*	9.7*	7.8*	9.9*	12.9	6.0	9.1
Indonesia	na	2.9	1.5	1.9	0.2	0.2	0.4	0.2	0.1	0.1	0.1
Iran	4.2*	3.0	2.8*	2.0*	1.7	1.6	1.8	1.7	1.5	1.2	1.0
Iraland	9.1	4.3r	10.6	7.8	3.4	4.5	4.7	4.6	2.8	na	na
Israel	na	na	16.9	9.4	9.7	11.3	12.1	11.2	10.4	6.3	5.8
Italy*	21.8	15.2	23.3	21.0	17.7	15.8	17.0	14.8	12.5	11.6	10.4
Japan*	35.5	26.9	32.5r	37.3	32.4	25.8	24.8	22.6	17.5	14.3	11.3
Mexico*	3.4	3.5	3.7	3.7	3.4	2.3	3.1	3.0	2.6	2.9	2.0
The Netherlands	28.3	18.4*	17.1*	14.8	13.4	16.0	12.6	12.2	10.7	8.8	7.8
New Zealand*	20.5	15.0*	26.5*	22.3*	12.5*	15.6*	19.2	14.6	11.6	12.1	9.2
Nicaragua	1.5	1.2	1.5	1.0	1.0	1.0	1.2	0.9	na	na	na
Norway*	55.8	43.6	51.6	37.8	37.5	33.1	31.0	33.6	29.6	24.3	18.3
Panama	2.6	2.6	3.8	3.4	2.9	2.7	2.4	2.6	2.3	3.1	2.2
Repl. of the Philippines	0.7	0.4	0.9	0.8	0.6	0.6	0.5	1.0	0.6	0.5	0.4
Portugal	2.9	2.2	7.7r	4.9r	5.7r	4.5	3.2	2.5	2.2	2.0	2.3
South Africa	6.0*	6.3	6.5	5.6	5.8	5.8	6.3	5.6	4.5	3.9	4.1
Spain	12.2*	11.6*	13.5*	12.0r*	9.6r*	7.0r*	7.0	7.1	5.5	5.0	6.5
Swedan	na	41.0	40.0r	34.7	32.8	29.8	32.0	31.1	24.6	21.8	24.8
Switzerland	27.9	22.2*	34.9*	31.1*	27.9*	22.9*	30.1*	27.5	22.9	18.9	21.9
Taiwan*	8.7	6.9	6.6	7.8	4.8	4.4	4.9	3.3	3.7	3.1	2.4
Turkey	1.3	2.6	2.6	na	1.7	1.5	0.8	0.8	0.8	0.6	0.5
United Kingdom*	24.8	21.7	27.4	27.5	24.3	22.1	24.4	23.8	21.9	20.5	20.3
United States*	58.0	44.9r	60.0	65.1	56.6	49.0	44.9	50.4	47.2	42.0	48.4
Venezuala	8.1*	6.1*	5.2*	4.8*	3.5*	3.2*	2.5*	2.9*	2.2*	3.4	2.0

* *Adjusted for inventory change* r- *Revised* na *Not available*

remarks, you can see the enormous potential for demand for finished aluminum from these countries. In addition, many of these countries have the resources to become major suppliers of raw material, energy and finished product to world markets. It's no secret that the energy and raw material equation changed back in 1973. So it is a question of how these countries, with either capital, energy and raw material, work to develop to take advantage of the enormous market that awaits them.

Those nations with either capital, energy and/or raw materials have to walk a fine line in their development of resources. Governments cannot usurp the price function of the world industry. It is not governments of any nation that create the demand for aluminum; as history has shown in the Western World, it was private industry.

In the development of resources within the developing nations, a partnership concept must evolve to the satisfaction of both the private and public sector. To be blunt, it is my opinion that governments usually lack the ability to develop new markets. They usually lack the ability to create markets through on-going research and development programs which are necessary to encourage the use of aluminum. They usually do not maintain nor do they have the ability to maintain, engineering services to sell aluminum and facilitate the solution of customers problems. Governments usually lack the necessary creativity to encourage the growth of aluminum in new markets.

Government-owned smelter operations usually do not react well to a market economy. They are designed for employment of resources and this creates an economic paradox. During periods of oversupply, it becomes difficult to maintain production flexibility based on supply/demand. In order to maintain employment, government-owned smelters usually will dispose of aluminum by cutting prices. This downward pressure on the price of aluminum could have disproportionate effect of government revenues. It can also create disunity among the developing nations, which depend on the price of aluminum as a revenue source. I think the best example of the problems of total government ownership of resources in the developing world is the copper industry. By refusing to allow the natural forces of supply/demand for correcting a market imbalance quickly, a prolonged period of depressed prices and revenue has festered which will eventually be corrected by the market forces anyway.

I believe that developing countries have an important role to play in the development of the world aluminum industry. It has to be approached in a sensible manner that will in the end be in the economic interest of all parties. It will be interesting for me to see how this world partnership is going to evolve.

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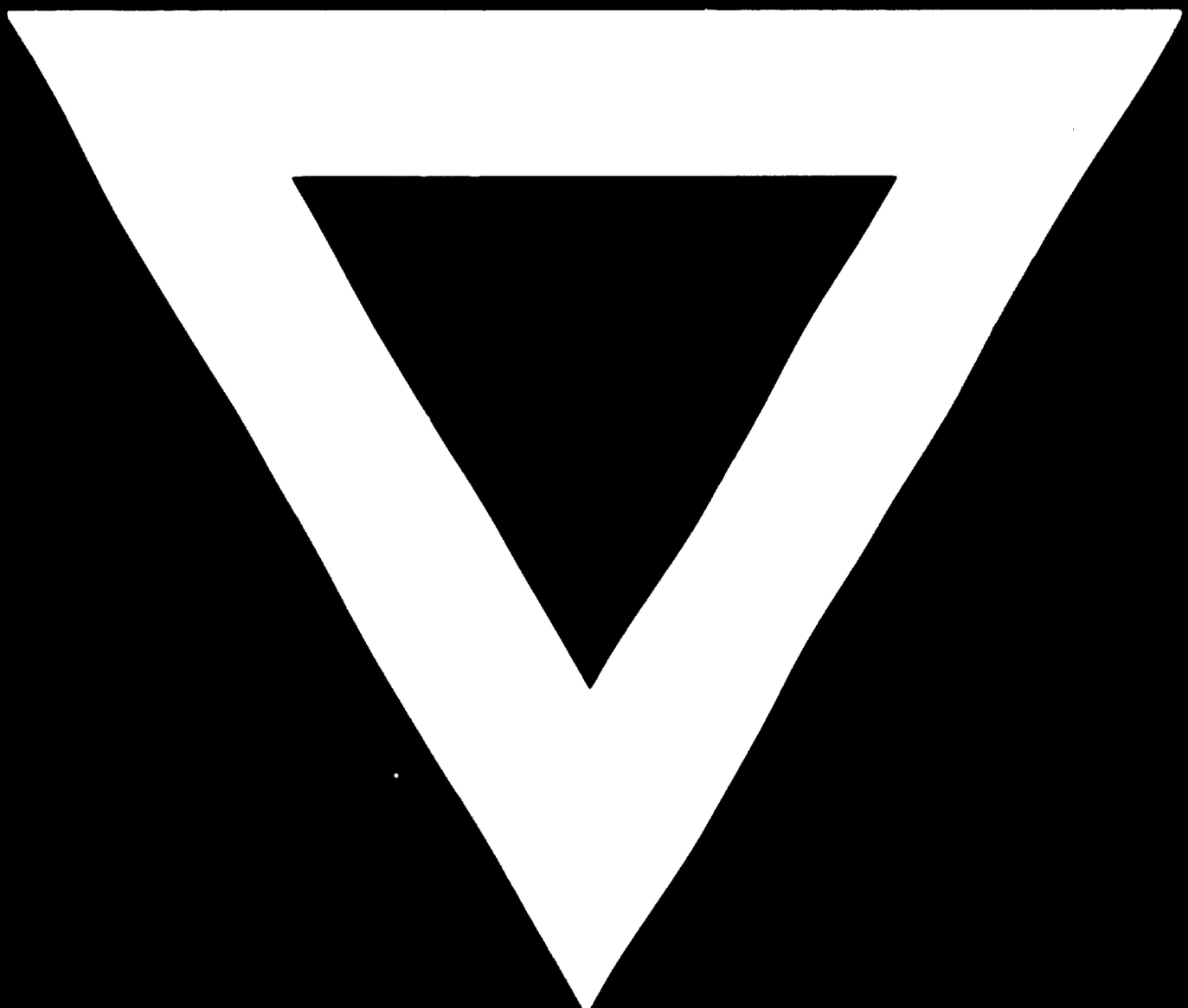

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