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Influences and trends in lead/acid battery demand, lead supply and prices

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Abstract

This study examines: (i) the historical trends and influences in Western World lead demand, paying particular attention to the battery sector; (ii) the historical trends in Western World lead production in both the primary and secondary sectors, highlighting key influences; (iii) the long-term relationship between consumption and both primary and secondary lead production, and (iv) the lead price and stock history, before summarizing the current situation in the lead market. Finally suggestions are given for a few points to watch for in the future. Most of the paper refers separately to 'Western World' and 'Eastern Bloc' countries. The definition of Western World includes all countries except the following: PR China, all CIS republics (the former USSR), Mongolia, North Korea, Cuba, Cambodia, Laos, Vietnam, and the Eastern European countries of Poland, Bulgaria, Romania, Czech and Slovak Republics, Hungary and Albania. These countries are collectively referred to as 'Eastern Bloc'. © 1997 Elsevier Science S.A.

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1. Lead demand

The lead/acid battery sector has increasingly dominated lead consumption. In 1980, the battery sector accounted for 48% of the total Western-World consumption of 3.95 million tonnes. By 1995, however, the battery sector accounted for 66% of the total Western-World lead consumption of 4.96 million tonnes (Fig. 1). In 1995, this battery sector share of lead consumption was as follows: SLI replacement batteries 62%; SLI original equipment (OE) batteries 23%; industrial (stationary and motive) batteries 15%.

The growth in battery demand has underpinned the growth in Western-World lead consumption in the long run (Fig. 2). From 1980 to 1995, battery demand has grown by 3.7% per annum, while total lead consumption in all sectors has risen by only 1.5% per annum. Also, lead consumption is arguably the least cyclical of all major metals as a large and growing proportion of lead consumption is accounted for by the replacement battery market, which in the long term is more influenced by vehicle populations and in the short term by seasonal weather patterns than by changes in industrial production or overall economic growth.

Having established the dominance of the battery sector in driving lead consumption higher in the long run, a summary is now given of the main influences that dictate lead demand in each of the sectors that make up the battery industry.

The demand for SLI original equipment (OE) batteries depends exclusively on vehicle production. This, in turn, depends on the demand for vehicles, which is itself a function of a number of factors that include vehicle prices, consumer incomes and confidence and a range of other largely intangible factors. Although cyclical in nature, Western-World vehicle production has shown a general upward trend in the long run. For example, in the European countries of Germany, France, Spain, Italy and the UK, vehicle output has collectively grown from 11.77 million units in 1985 to 13.96 million units in 1995.

The demand for replacement SLI batteries is related to vehicle population and average battery life. These, in turn are, determined by battery technologies in use and by battery operating conditions (e.g. climate). Vehicle populations have grown steadily since 1980 with an average annual growth of 3% in Europe, for example. The rate of

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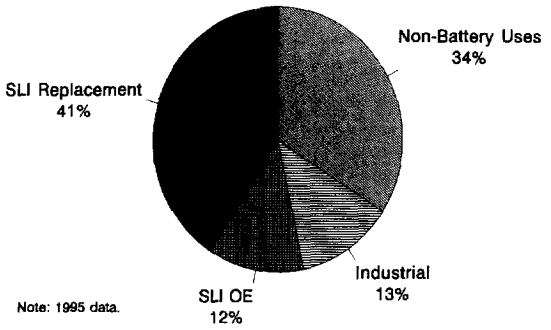

Fig. 1. Battery sector dominates lead consumption.

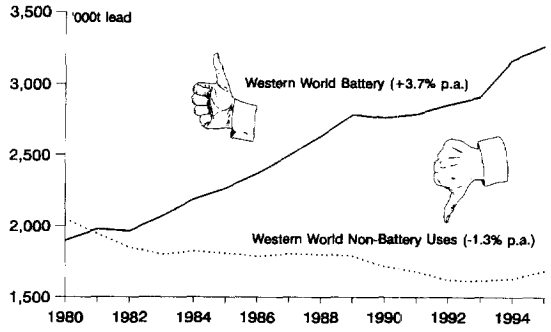

Fig. 3. Demand in battery growth in contrast to the decline in non-battery uses.

growth in any one year is determined by the number of new vehicle sales minus the number of vehicles scrapped. As the vehicle population has grown, so the replacement battery sector has grown in importance, and this upward trend is likely to continue. Changes in battery design have lengthened battery life; average battery life in Western Europe is estimated to have risen from less than three years in the late 1970s to over five years since the early 1990s. While the long-term trend in replacement battery demand has undoubtedly been upwards, the shorter-term trend is more erratic, with battery operating conditions playing an important role. One of the most important short-term influences is extremes of temperature. Extended periods of either high or low temperatures will tend to place extra demands on the SLI battery and will shorten the battery life.

Another influence on lead consumption in the SLI battery sectors is the amount of lead used for each battery unit. Lead usage per SLI battery had been in decline since the mid-1970s, fuelled by the oil crisis which spurred vehicle manufacturers to reduce vehicle weights in order to improve fuel efficiency. For example, lead content per SLI battery in the USA fell from about 12 to 13 kg in the mid-1970s to only 7–8 kg by the early 1980s, with similar trends in Europe and Japan. This trend appears to have been reversed recently, with lead content per SLI battery rising as vehicle manufacturers increasingly compete on the basis of quality rather than fuel efficiency. One factor behind this recent trend reversal is the rising electrical requirements placed on the battery for electric windows, air-conditioning, etc.

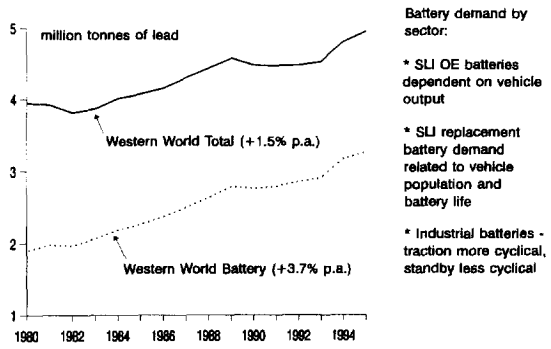

Fig. 2. Growth in battery demand underpins rise in lead consumption.

Industrial batteries have been the fastest growing end-use for lead, with an annual average growth of almost 6% from 1980 to 1995. This small, but growing, sector can be sub-divided into traction (motive power) batteries and stand-by (or stationary) batteries. Traction batteries are more important, accounting for around two-thirds of industrial battery lead demand, with uses that include fork-lift trucks and golf carts. Stand-by batteries are used to provide power in a range of applications such as telecommunications (telephones, radios) and uninterruptible power supplies (computers, hospitals). The stand-by battery demand has in the past grown more steadily than traction demand, as the latter tends to be more cyclical and follows trends in industrial production.

The growth in battery demand in the long run is in contrast to the accompanying decline in non-battery uses (Fig. 3). From 1980 to 1995, battery demand grew by 3.7% per annum while non-battery demand fell by 1.3% per annum.

The main influence behind the decline in non-battery uses has been substitution of lead by other materials in a number of end-uses. Substitution has been prompted by developments in the relative prices of various materials, technical developments and, perhaps most topically, by environmental health risks. As a first example, the use of lead in cable sheathing has been in steady decline through its substitution by plastics and aluminium; its use has halved in the last 15 years from 322 000 tonnes of lead in 1980 to only 160 000 tonnes in 1995. Lead sheathing has only held its own in specialized fields where its moisture, chemical resistance and durability are crucial, as in submarine power cable use. Even where lead is used, however, its thickness has invariably been reduced.

An example of where environmental health factors have become an increasingly important influence on lead usage is in the chemical industry since the 1970s. For example, the use of tetraethyl lead (TEL) as a fuel additive was targeted as a health hazard in legislation introduced in the USA from 1973, and later in other industrialized countries,

and the move to lead-free petrol has been accelerating ever since. For example, TEL consumption in Western Europe is estimated to have fallen from 107 000 tonnes in 1980 to less than 50 000 tonnes in 1995.

2. Lead production

The data in Fig. 4 show clearly that refined lead production tracks consumption upwards in the long run. Western-World refined lead production has grown from 2.51 million tonnes in 1960 to 4.56 million tonnes in 1995, an average annual growth rate of 1.7%. Western-World refined lead consumption has grown from 2.35 million tonnes in 1960 to 4.96 million tonnes in 1995, an average annual growth rate of 2.2%. Thus, the key determinant of long-run lead production is the long-run trend in lead consumption. In the short-term, however, production is more closely related to factors such as price movements and raw material availability.

While total refined output has grown, the primary and secondary sectors that make up this total show contrasting fortunes. The long-run growth in secondary lead output contrasts the long-run decline in primary lead output, see Fig. 5. Western-World secondary lead output is estimated to have risen by 2.1% per annum from 1980 to 1995, while Western-World primary lead output is estimated to have fallen by 0.6% per annum in the same period. In 1995, secondary output accounted for 54% of total Western-World refined lead production, compared with only 43% in 1980.

Driving secondary lead output higher has been the growth in battery-scrap supplies which, in turn, have risen in line with the growth in replacement battery demand. Underpinning this strong output growth have been substantial changes in the structure of the secondary lead industry in the last ten years or so. Recycling rates have risen as the flow of scrap in industrialized countries has become more regulated, mainly due to increasing environmental legislation. While recycling rates have risen, secondary smelter production costs have fallen due to lower scrap feed and conversion costs and, therefore, have allowed many smelters to operate at lower lead prices, despite rising environmental compliance costs.

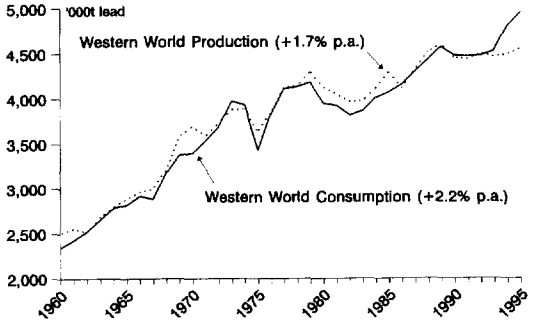

Fig. 4. Lead production tracks consumption in the long run.

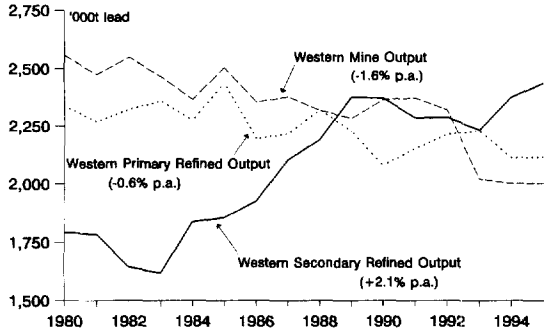

Fig. 5. Secondary refined output overtakes primary production.

In contrast to the strong growth in secondary output, primary refined lead production has been in decline in the long run. A key influence has been the long-run fall in lead mine output, with mine closures outstripping new mine output. Western-World mine output is estimated to have fallen by 1.6% per annum from 1980 to 1995 (equivalent to over 500 000 tonnes of contained lead-in-concentrate).

The divergent historical trends in secondary and primary lead production have been further reinforced in the 1990s by a series of primary smelter closures (Santa Lucia in Spain, IMMSA in Mexico, Kabwe in Zambia, Plumbum in Brazil, Naoshima and Saganoseki in Japan).

Another important development has been the greater usage of secondary materials at remaining primary plants. Faced with the erratic nature of lead concentrate supplies, with most mines producing lead as a by-product of zinc or silver, and the emergence of direct smelting technologies that enable greater flexibility to treat more secondary materials, secondary feed as a proportion of total feed for primary smelters has been rising. CRU recently estimated that secondary production at Western primary plants accounted for 10% (or 200 000 tonnes) of total refined lead output at 'primary' plants in 1990, rising to almost 20% (or 380 000 tonnes) in 1995. This trend of secondary growth and primary decline is most dramatically shown in Japan, where two primary lead refineries have closed (Naoshima and Saganoseki) and two others have switched from primary to secondary feed (Kamioka and Hosokura). From 1993 to 1995, Japanese primary lead output fell by over 60 000 tonnes while secondary lead output rose by over 40 000 tonnes.

3. Relationship between demand and production

Having already seen the close long-term relationship between lead consumption and production, a brief examination will now be given of the relationships between consumption and secondary production, and consumption and primary production.

The data in Fig. 6 show that secondary lead output mirrors both the trend and cycle in lead consumption.

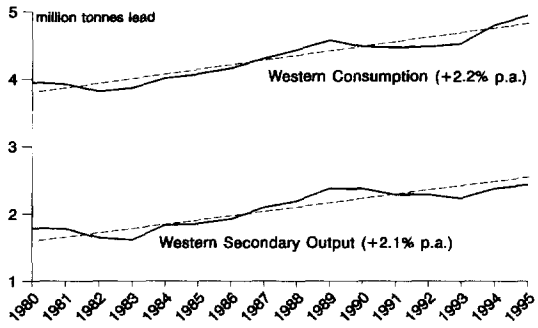

Fig. 6. Secondary lead output follows trend and fluctuations in consumption.

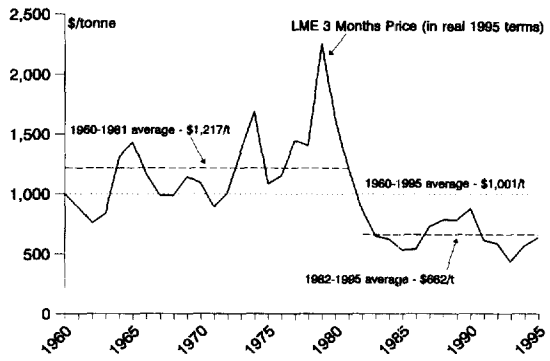

Fig. 8. Lead price has fallen since the early 1980s.

There is such a close relationship because almost all the growth in secondary lead output has been from the dominant replacement battery sector in lead consumption that generates scrap after a lag. By contrast, the output of primary lead diverges from lead consumption (see Fig. 7).

Historically, while primary production has declined in the long run, secondary production has risen and the secondary sector has been more responsive in the short-term to changes in prices and demand. In the past, the primary sector has been not so responsive to short-term changes in prices and demand, and so the burden of short-term responsiveness of supply has rested on the secondary sector. The primary sector is becoming more responsive, however, as usage of secondary materials at primary plants increases in importance.

4. Lead stocks and prices — past and current

The dramatic fall in lead prices in the early 1980s is shown in Fig. 8. From 1960 to 1981, the price averaged US$ 1217/tonne, but from 1982 to 1995 the price average fell to only US$ 662/tonne, a fall of 46%. The price is shown in real 1995 terms in order to isolate fundamental long-run changes in the price of lead from the effects of inflation.

The sustained fall in prices since the early 1980s is due to a series of structural changes. These include the decline in non-battery uses (which slowed consumption growth), lower scrap costs (effectively lowering the 'floor' price for lead), and higher recycling rates (by government intervention, accelerating secondary output growth). In the early 1990s, a new factor was the dramatic switch in Eastern Bloc trade from net importer to net exporter, putting renewed downward pressure on prices. After the record lows in the early 1990s, due to the double blow of world-wide recession and a flood of Eastern Bloc exports (first from the CIS and then PR China), the lead price has recovered over the last three years or so. The London Metal Exchange (LME) three-month lead price has more than doubled from a low of US$ 369/tonne in October 1993 to a high of US$ 853/tonne in May 1996. Nevertheless, prices still have a long way to climb if they are to return to the pre-1980s levels.

One of the most important influences on prices is stocks. Stock changes provide a good indication of the underlying lead supply and demand balance and can have an important influence on prices. Also, the absolute level of lead stocks at any time is itself a function of current or expected prices. The relationship also depends on where the stocks are held, and who holds them. The stock data in Fig. 9 only include reported stocks held by producers, consumers, merchants and the LME, so it should only be used as a guide to stock trends. It can be seen clearly that there is an inverse long-term correlation between stock and prices; high stocks coincide with low prices and low stocks

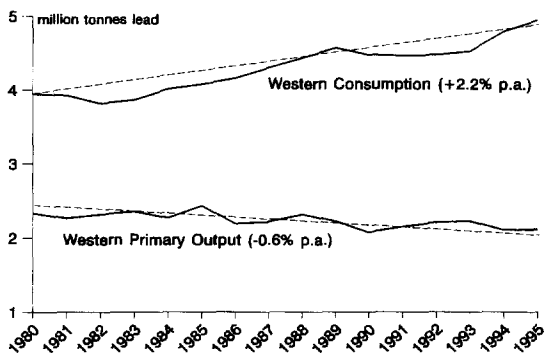

Fig. 7. Primary lead output and consumption diverge.

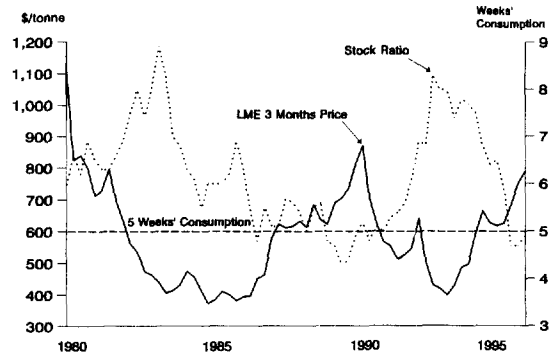

Fig. 9. Good inverse relationship between stocks and prices.

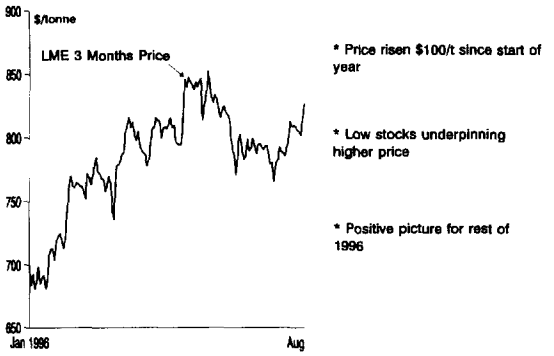

Fig. 10. Lead prices higher in 1996.

coincide with high prices. The stocks are shown in terms of weeks' consumption to take account of the historical growth in consumption, which means that the stock ratio for the same stock level will be lower in 1995 than in 1980. The results show that the stock ratio has fallen sharply since 1993; this reflects the physical market moving into deficit. This fall corresponds with a rise in prices. Since the early 1980s, a fall in the stock ratio towards and then below five weeks has proved to be the trigger for higher prices, for example in 1990. With the stock ratio again below five weeks, prices have risen strongly this year.

Lead prices have generally performed well in 1996, and the outlook remains positive, at least for the rest of this year as demand reaches its seasonal peak over the winter (see Fig. 10). The LME three-month lead price has risen from just under US$ 700/tonne in January to a maximum of US$ 850/tonne in May. This upward move was driven by falling stocks as lead demand outstripped supply. It is also interesting to note that the lead price has been outperforming other LME metals this year (see Fig. 11).

5. Future trends in lead market

As discussed above, lead prices have recovered in recent years, and more price gains seem likely over the next year or so. Nevertheless, the long-term prospects for the lead industry are less certain. This final section will briefly touch on a few fundamental change that could turn prices either way in the longer run.

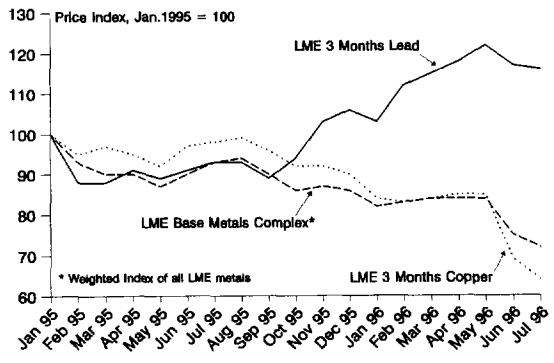

Fig. 11. Lead outperforming other metals.

5.1. Could lead consumption growth accelerate?

Future growth in lead consumption will be driven largely by continued growth in the SLI battery sector in all regions, most notably in Asian and Eastern Bloc countries, as vehicle production and population continue to grow. Industrial battery demand is also expected to contribute to higher consumption, with stand-by battery applications for telecommunications in particular offering good potential for growth. Another factor that will increase lead/acid battery demand is its use, at least initially, as the preferred battery technology for electric vehicles (EVs). It is difficult to predict how much extra lead consumption EV demand will generate — the author believes that the impact will be minimal, accounting for less than 40 000 to 50 000 tonnes of lead by the year 2000. Non-battery demand has been in steady decline, but there does appear to be less scope for substitution in the remaining uses. Indeed, non-battery demand could even increase in the future, with lead usage in glass screens for computers and televisions likely to continue growing. This, along with steady growth in SLI battery demand and rising growth in industrial battery demand, could result in lead consumption growing more quickly than before.

5.2. How much scope for secondary output to rise further?

Secondary lead output growth has been underpinned by growth in replacement battery demand and CRU believes that future growth will be largely dictated by this close relationship. In the past, recycling rates have risen as the flow of scrap has become more regulated in many countries, but CRU believes that there is now limited scope for recycling rates to increase as they are already at, or above, 90% in most industrialized countries. CRU also understands that recycling rates are already high in many developing countries; although the scrap-collection system is less regulated, scrap batteries have a high value in these low-income countries, which is a major incentive for collection.

5.3. Can primary smelters grow with higher mine output?

Western mine output has already risen sharply this year, up an estimated 10% year-on-year in the first six months of 1996. More rises in output are expected over the next three to four years with a number of new mines, reopenings and expansions to existing mines. With concentrate supplies improving, primary refined lead output is rising. Is this the start of a sustainable recovery in primary lead output? Could a smelter capacity bottleneck constrain future rises? Or will the long-run decline in the primary smelting industry continue? One factor which could deter-

mine how much Western primary lead smelter production and capacity expand if part or all of the emerging Western concentrates surplus is soaked up by spare Eastern Bloc smelter capacity, mainly in PR China and Kazakhstan.

5.4. Will Eastern Bloc remains net exporter?

Exports of lead from Eastern Bloc countries remain high. The origin has changed dramatically in recent years — CIS lead exports have slumped, as Russian consumption has risen and Kazakh output has fallen, and Bulgaria now ships more lead to the West. PR China has emerged as the largest exporter of all. Are higher Chinese shipments here to stay or will they follow the decline in CIS shipments? We believe that the CIS could soon become a net importer and that both Bulgarian and Chinese exports to the West could fall as more lead is consumed internally or in other Eastern Bloc countries as economic growth continues.

5.5. Price explosion or cyclical downturn ahead?

While the immediate prospects are bullish, how high prices will go in the longer term depends, at least partly, on the issues raised above. If some, or all, of the structural changes putting downward pressure on prices are removed, for example, if the Eastern Bloc returns to net importer, lead prices could return to pre-1980 levels. The 1980–1990s prices would then be seen as a long-run floor price rather than the medium-run average. The current strength in the lead market could prove yet again to be a false dawn, however, with the market cycle once again moving the market back into surplus before the turn of the century, causing prices to once again fall back towards the 1982–1995 average of US$ 662/tonne (in real 1995 terms).

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