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PART TWO

STATISTICS
OF
PRODUCTION, CONSUMPTION AND TRADE

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STRUCTURE OF PRODUCTION

21.1 - ORE AND CONCENTRATE PRODUCERS. PRODUCTION STATISTICS

(tables 21.1.1 to 21.1.4)

The Western world's production of lead ores, expressed in metal content, moved up from 1.85 Mt in 1963 to 2.6 Mt in 1972, with a 3.9 % average increase per annum. Over the following period, it fluctuated around 2.5 Mt (-1.4 % per annum from 1972 to 1976), after registering in 1973 the same level as in the immediately preceding years.

The Eastern world, with a 4.0 % growth rate until 1972 and 2.9 % in the following years, moved up from 0.7 Mt in 1963 to 1.1 Mt in 1976.

As far as the major producing countries of the Western world are concerned, the United States, which in 1963 accounted for 10 % of the total, registered 23 % in the most recent years.
Australia's production, though with some fluctuations, is on the average rather stable in terms of absolute values and currently accounts for about 16 % of world production.
The other major producing countries are Canada, Mexico, and Peru, which together represent over 25 % of the total.

The EEC as a whole moved up from 100 000 tons in 1963 to 200 000 tons in 1967, to start after that year a reverse trend which brought production in recent years around 130 000 tons, equal to 5 %-5.5 % of the total.
The EEC lead ore producers, with the exception of the U.K. which never registered a production higher than 5 000 tons, and the evolution of their incidence on the Western world as a whole, are shown below :

	1967	1976
France	1.2 %	1.2 %
Germany F.R.	3.1 %	1.7 %
Ireland	2.7 %	1.3 %
Italy	1.8 %	1.2 %

TABLE 21.1.1.

MINE PRODUCTION OF LEAD - METAL CONTENT

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
France		27.4	26.4	30.2	28.8	29.8	26.6	25.0	23.5	21.7	28.0
Germany F.R.		68.0	61.3	51.5	50.0	50.1	46.2	45.4	42.7	43.0	42.1
Ireland		59.5	62.2	59.9	64.2	51.6	59.6	56.2	37.7	36.3	32.6
Italy		38.7	36.5	37.0	35.2	31.6	33.7	25.9	23.3	25.5	30.1
United Kingdom		3.2	3.5	3.7	4.1	5.0	3.1	3.3	2.7	3.5	2.5
	E E C	196.8	189.9	182.3	182.3	168.1	169.2	155.8	129.9	130.0	135.3
Other Europe		267.5	279.7	292.5	301.2	299.9	295.4	294.6	314.1	303.5	337.5
	EUROPE	464.3	469.5	474.8	483.5	468.0	464.6	450.4	444.0	433.5	472.8
Morocco		78.0	81.0	77.6	76.1	78.5	86.1	93.2	86.3	69.9	67.1
South West Africa		70.2	60.8	75.7	70.5	73.2	53.0	63.3	51.3	48.3	42.3
Other Africa		45.5	49.4	60.1	61.2	57.4	55.9	47.3	46.1	46.2	31.0
	AFRICA	193.7	191.2	213.4	207.8	209.1	195.0	203.8	183.7	164.4	140.4
Iran		15.0	16.0	18.8	20.9	24.0	33.0	37.5	47.5	50.0	35.0
Japan		63.5	63.9	63.5	64.4	70.6	63.4	52.9	44.2	50.6	51.7
Turkey		5.7	6.8	7.0	8.0	10.0	12.0	15.0	17.0	22.9	29.2
Other Asia		31.2	31.9	31.1	27.7	25.1	22.7	30.6	26.1	36.1	39.9
	ASIA	115.4	118.6	120.4	121.0	129.7	131.1	136.0	134.8	159.6	155.8
Canada		316.9	329.7	302.0	357.2	394.8	376.3	387.8	301.4	352.5	247.1
Mexico		165.8	161.7	166.4	171.6	173.7	161.4	179.3	218.0	178.6	200.0
Peru		163.2	164.9	160.0	164.0	147.4	184.4	183.4	165.8	177.6	182.1
USA		299.5	339.4	481.0	540.3	546.7	584.9	569.8	602.3	576.5	566.3
Other America		91.3	96.4	98.7	106.0	105.4	109.0	106.2	108.5	106.0	98.6
	AMERICA	1,036.7	1,092.1	1,208.1	1,339.1	1,368.0	1,416.0	1,426.5	1,396.0	1,391.2	1,294.1
	OCEANIA	382.0	389.0	453.0	457.7	404.8	397.6	403.4	375.3	407.7	399.3
	WESTERN WORLD	2,192.1	2,260.5	2,469.7	2,609.1	2,579.6	2,604.3	2,620.1	2,533.8	2,556.4	2,462.4
	EASTERN WORLD	773.6	799.7	844.8	864.9	913.3	965.0	1,018.8	1,044.6	1,089.6	1,083.4
	TOTAL	2,965.7	3,060.2	3,314.5	3,474.0	3,492.9	3,569.3	3,638.9	3,578.4	3,646.0	3,545.8

TABLE 21.1.2.

GROWTH IN MINE PRODUCTION OF LEAD
(percentage per annum)

		1972/1963	1976/1972
France		+ 13.7	+ 1.3
Germany F.R.		- 2.1	- 2.3
Ireland		+ 6.9 (1)	- 14.0
Italy		+ 0.3	- 2.8
United Kingdom		+ 7.6	- 5.2
	E E C	+ 6.2	- 5.4
Other Europe		+ 1.6	+ 3.4
	EUROPE	+ 3.0	+ 0.4
Morocco		+ 1.7	- 6.0
South West Africa		- 2.8	- 5.5
Other Africa		+ 3.5	- 13.7
	AFRICA	+ 0.7	- 7.9
Iran		+ 14.2	+ 1.5
Japan		+ 2.1	- 5.0
Turkey		+ 18.5	+ 24.9
Other Asia		- 2.6	+ 15.1
	ASIA	+ 3.8	+ 4.4
Canada		+ 8.7	- 10.9
Mexico		- 0.7	+ 5.5
Peru		+ 3.1	- 0.3
USA		+ 10.6	- 0.8
Other America		+ 5.0	- 2.5
	AMERICA	+ 6.6	- 2.2
	OCEANIA	- 0.5	+ 0.1
	WESTERN WORLD	+ 3.9	- 1.4
	EASTERN WORLD	+ 4.0	+ 2.9
	T O T A L	+ 3.9	- 0.2

(1) It refers to 1972-1966 as from 1966 onwards production became significant.

As regards zinc ores, production, still expressed in metal content, rose in the period 1963 to 1972 from 2.9 to about 4.5 Mt, with a 4.9 % average growth rate per annum, and subsequently, though with fluctuations, surpassed 4.6 Mt in 1976 (+0.8 % per annum from 1972 to 1976.

The Eastern world, with a 6.4 % increase per annum until 1972 and 3.9 % in the following period, rose from 0.8 Mt in 1963 to 1.65 Mt in 1976.

Among the major producing countries of the Western world, Canada, which in 1963 accounted for about 15 % of the total, in the most recent years usually accounted for 27 %-29 %, while the United States reduced their quota which fell to 10 %-11 % in the recent years.
A 10 % quota was also held by Australia and Peru.
Among the minor countries of a certain importance,Mexico and Japan are to be considered (5 %-6 % of the total, each).

The EEC as a whole, which in 1963 produced 250 000 tons of zinc ores, reached a peak of 407 000 tons in 1969, to suffer after that time from a continuous decline until 1974-1975 and register somewhat a recovery in 1976 (due to improvements occurred in France and Italy), thus reaching approx. 330 000 tons, equal to roughly 7 % of the total.
The EEC producers, with the exception of the United Kingdom which is negligible, and the evolution of their incidence on the Western world, are shown below :

	1967	1976
France	0.6 %	0.7 %
Germany F.R.	3.6 %	3.1 %
Ireland	0.8 %	1.4 %
Italy	3.2 %	1.9 %

TABLE 21.1.3.

MINE PRODUCTION OF ZINC - METAL CONTENT

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
France		24.9	21.8	20.1	18.6	15.1	13.3	13.3	14.3	13.9	34.7
Germany F.R.		142.8	147.3	157.3	160.8	164.9	151.7	151.9	144.5	144.4	143.0
Ireland		30.0	53.3	97.4	96.5	87.5	94.9	68.8	66.3	66.6	62.8
Italy		124.6	140.0	132.3	110.7	105.9	102.6	78.6	77.7	78.8	88.5
United Kingdom		-	-	-	-	-	1.2	2.9	2.8	2.8	3.3
	E E C	322.3	362.4	407.1	386.6	373.4	363.7	315.5	305.6	306.5	332.3
Other Europe		302.6	347.1	324.9	357.6	378.3	400.8	453.9	514.4	497.8	529.1
	EUROPE	624.9	709.5	732.0	744.2	751.7	764.5	769.4	820.0	804.3	861.4
South Africa		-	-	-	-	-	2.4	18.7	32.6	67.3	77.1
South West Africa		22.6	23.2	38.2	46.9	48.9	41.9	33.9	44.9	45.6	45.5
Zaire		122.0	119.3	96.0	104.3	108.6	99.5	88.4	90.6	80.4	90.0
Zambia		54.4	67.2	68.2	65.8	68.7	70.5	73.2	80.5	66.3	48.8
Other Africa		56.2	62.0	68.6	45.6	41.0	52.3	47.0	34.5	41.2	34.9
	AFRICA	255.2	271.7	271.0	262.6	267.2	266.6	261.2	283.1	300.8	296.3
Iran		24.0	27.0	26.5	28.8	40.0	47.5	32.5	42.5	80.0	72.0
Japan		262.7	264.3	269.4	279.7	294.4	281.1	264.0	240.8	253.7	260.0
South Korea		13.7	19.3	20.6	23.4	30.1	37.3	48.3	42.3	45.7	56.2
Turkey		8.6	14.8	18.5	23.8	19.3	17.2	24.7	23.3	24.8	45.8
Other Asia		13.9	15.0	16.8	15.9	17.2	18.7	25.3	62.6	40.4	40.9
	ASIA	322.9	340.4	351.8	371.6	401.0	401.8	394.8	411.5	444.6	474.9
Argentina		29.0	26.2	32.0	39.0	42.0	44.5	40.6	39.6	37.4	40.6
Bolivia		16.0	10.0	34.2	47.0	45.8	39.7	48.9	49.0	49.5	48.5
Canada		1,129.0	1,165.9	1,170.4	1,253.1	1,270.3	1,278.6	1,357.6	1,240.2	1,229.5	1,158.4
Mexico		236.6	235.8	251.6	263.0	261.2	267.0	271.4	262.7	228.9	259.2
Peru		328.6	303.3	315.0	329.0	318.1	376.1	412.0	397.2	420.8	458.5
USA		547.7	527.8	551.4	532.5	501.0	476.8	477.4	498.3	467.9	476.0
Other America		23.0	18.0	27.0	35.0	41.0	59.6	74.0	80.5	78.3	91.4
	AMERICA	2,309.9	2,287.0	2,381.6	2,498.6	2,479.4	2,542.3	2,681.9	2,567.5	2,512.3	2,532.6
	OCEANIA	406.9	424.4	509.9	488.7	454.6	508.8	481.1	457.1	500.8	467.6
	WESTERN WORLD	3,919.8	4,033.0	4,246.3	4,365.7	4,353.9	4,484.0	4,588.4	4,539.2	4,562.8	4,632.8
	EASTERN WORLD	1,082.2	1,151.8	1,240.3	1,309.9	1,378.4	1,416.9	1,551.6	1,597.0	1,659.1	1,651.7
	TOTAL	5,002.0	5,184.8	5,486.6	5,675.6	5,732.3	5,900.9	6,140.0	6,136.2	6,221.9	6,284.5

TABLE 21.1.4.

GROWTH IN MINE PRODUCTION OF ZINC
(percentage per annum)

		1972-1963	1976-1972
France		- 3.4	+27.1
Germany F.R.		+ 2.1	- 1.5
Ireland		+27.5 (1)	- 9.8
Italy		- 0.5	- 3.6
United Kingdom		(2)	(2)
	E E C	+ 4.2	- 2.2
Other Europe		+ 1.8	+ 7.2
	EUROPE	+ 2.9	+ 3.0
Zaire		- 0.4	- 2.5
Zambia		+ 7.0	- 8.8
Other Africa		- 0.9	+13.0
	AFRICA	+ 0.9	+ 2.7
Japan		+ 4.0	- 1.9
Other Asia		+15.0	+15.5
	ASIA	+ 6.3	+ 4.3
Canada		+12.5	- 2.4
Mexico		+ 1.6	- 0.7
Peru		+ 5.0	+ 5.1
USA		- 0.9	- 0.0
Other America		+14.1	+ 5.8
	AMERICA	+ 6.2	- 0.1
	OCEANIA	+ 4.0	- 2.1
	WESTERN WORLD	+ 4.9	+ 0.8
	EASTERN WORLD	+ 6.4	+ 3.9
	TOTAL	+ 5.3	+ 1.6

(1) It refers to 1972-1966 as from 1966 onwards production became significant.
(2) Insignificant data.

21.2 SCRAP AVAILABILITY

21.21 Recycling

21.21.A - Introduction

Recycling is accomplished by the secondary materials industry. The task of the procurement, identification and sorting, smelting, refining, and sale of scrap for use at the first processing stage are functions of the recycling industry.

The scrap processors, secondary smelters, and other companies have developed effective channels and efficient methods for recycling nearly all waste materials of economic value, in the traditional economic environment.

More recently, additional dimensions have been added to this traditional environment. These new dimensions are (1) improvement of the living environment; (2) increased national concern with conservation of natural resources; (3) necessity to limit to a minimum the dependance on foreign raw materials supply.

No longer is economic gain the sole driving force for recycling of waste materials. In an economic-based economical area this creates problems of interpretation and evaluation of non-economic-based goals and activities. It is therefore necessary to tackle comprehensively the problem of extending recycling to marginal and sub-marginal solid waste, to allow more materials to be recycled;by removing impediments of a fiscal and legal nature; by creating some forms of incentive and promotion; and by the realization of research and development programmes to improve collecting and processing methods to ameliorate economies in recycling.

Each metal poses different problems because of the characteristics and uses of the metal, the pattern of consumption and the average life cycle of the products. Such problems are notable in the case of copper, less so regarding lead, and even less so for zinc.

The study is based on statistical and scientific documentation as well as on the results of specific surveys carried out by BIPE, Charter Consolidated Ltd., ITE on behalf of the EEC.

The criteria adopted for compiling statistical data, the lack in almost all industrialized countries of direct and analytical data on commercial flow of products entering the market and on secondary recycled materials,

compel to frame hypotheses and to set parameters for estimating scrap arisings, which differ as to the various countries because of variable consumption patterns and structure of industry.
Consequently the absolute values of recycled materials may appear to be somewhat defective. We deem however that the error incurred might not be such as to invalidate the conclusions arrived at in this study.

21.21.B - The recycling industry

Figure 21.2.1 shows the two major types of scrap that are the raw materials of the recycling industry : prompt industrial and obsolete. Prompt industrial scrap is the waste generated during a manufacturing operation. Obsolete scrap is generated when a used product is no longer useful and is discarded. This includes a great variety of types of scrap and situations : wide variety in value, time scale of recycling, and form of obsolete scrap.

Scrap trading is performed according to two possible circuits :

- a direct circuit from 'scrap producer' to user : this circuit is used almost exclusively for a part of scrap at manufacturing and fabricating stages;

- an indirect circuit which passes through an intermediate stage formed by scrap dealers/merchants : this is practically the only circuit used for obsolete products, it is however used also for a part of scrap at manufacturing and fabricating stages.

Table 21.2.1 provides an analysis of the major types of recyclable materials.

21.21.C - Structure of scrap metal trade

Old and new scrap is sold through a complex and highly fragmented industry. Merchants provide the link between producers of scrap and end-users. At the base of the collection system are the local scrap dealers and itinerant collectors who buy in small quantities from the public or from industry on factory clearance contracts.

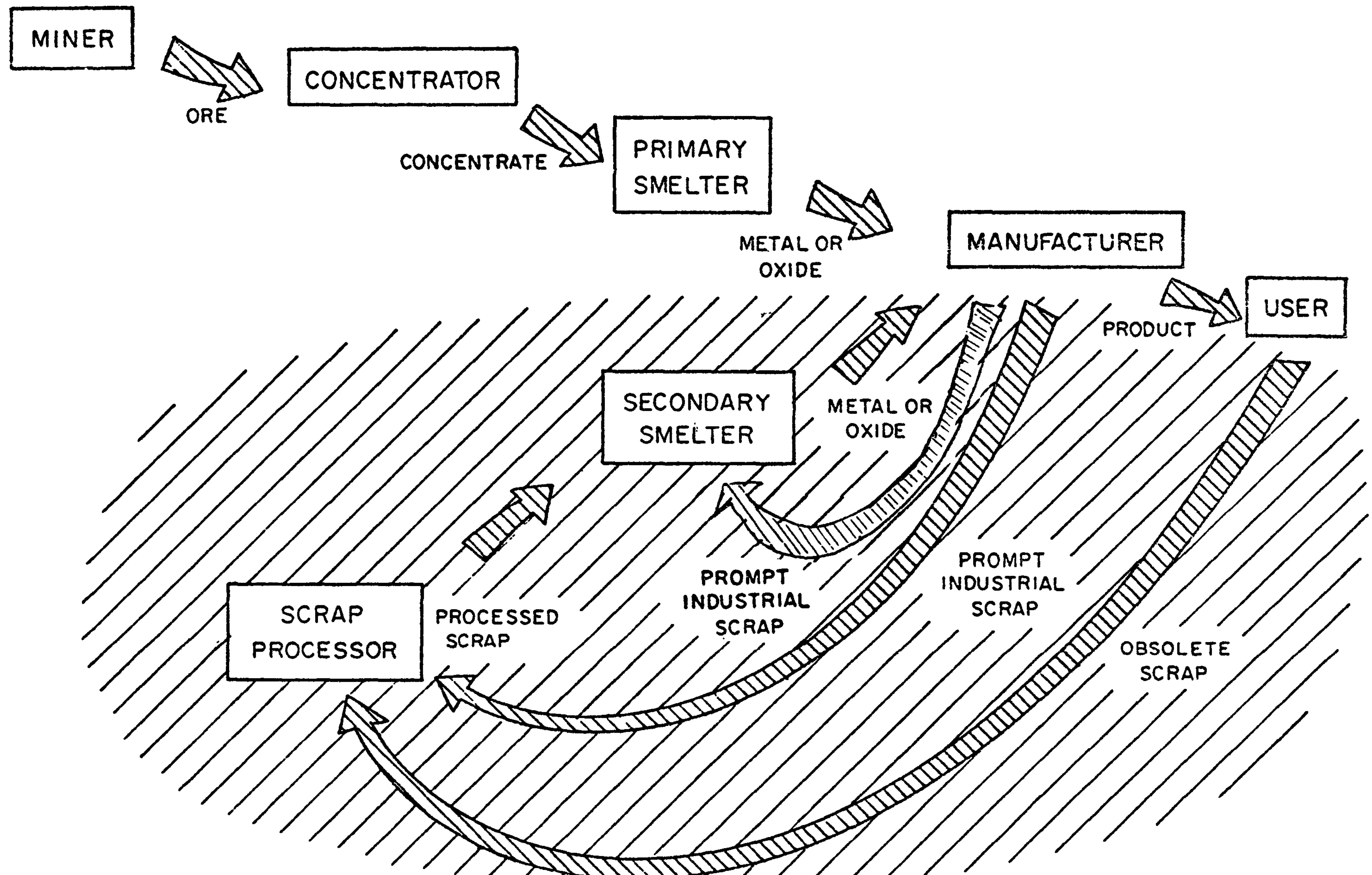

FIGURE 21.2.1. : FLOW OF PRIMARY AND RECYCLED METALS

TABLE 21.2.1.- ANALYSIS OF TYPES OF RECYCLABLE MATERIALS

Type of Material	Examples	Condition of Scrap	Sources
Manufacturing residues	Drosses Slags Skimmings	Highly variable in composition depending on the major constituents.	Metal melting operations - smelters, casters
Manufacturing trimmings	Machining wastes Blanking and stamping trimmings Wasting wastes	Highly variable as to size and shape.	Shaping operations - casters, stampers, machiners, fabric cutters, paper cutters.
Manufacturing overruns	Obsolete new parts Extra parts	Usually small size. Variable compositions.	Large manufacturers of mass-produced products.
Manufacturing composite wastes		Highly variable as to composition, size and shape. Often costly to process. Often, not all constituents are recovered.	No significant pattern of sources.
Flue dusts	Brass mill dust Steel furnace dust	Highly variable in composition and bulk density. Often not economical to recover.	Metal smelter and caster
Chemical wastes	Spent plating solutions Processing plant sludges, residues and sewage	Highly variable in composition. High value materials often recoverable.	Platers, metal cleaners, process industry plants.
Old 'pure' scrap	Lead sheet and pipe Zinc sheet	Highly variable as to size and shape.	Consumers, industrial users, utilities, and other uses of the products that are scrapped.
Old composite scrap	Irony die castings Auto radiators Batteries	Irony die castings: Highly variable as to composition, size, shape, and difficulty of separation. Often not economical to recover valuable materials.	Consumers, industrial users, utilities, and other uses of the products that are scrapped
Old mixed scrap	Auto hulks Appliances	Highly variable as to composition, size, shape, and difficulty of separation. Not all materials are recovered.	Consumers, industrial users, utilities, and other users of the products that are scrapped.
Solid wastes	Municipal refuse Industrial trash Demolition debris	Completely variable. Nearly always low in valuable materials. Very low recovery rates now.	All individuals and organizations.

Source: Battelle-Columbus estimates of recycle rates
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At this stage of the industry the scrap dealers/merchants are numerous and widely dispersed, though located in those areas of the country which have the largest concentration of industry and hence the largest potential sources of scrap.

From the first tier, the material is sorted and eventually baled before being passed on to larger dealers who in turn, after further processing, pass the material to the end-users. The large merchants buy scrap wherever it arises in reasonable quantities, i.e. from medium size merchants, direct from process scrap producers, from ship and car breakers, demolition companies and by tender from the Post Office, Government Departments and Electricity Boards etc ...

Since the price large merchants can obtain from the end-user is affected markedly by the homogeneity and size of scrap lots they have to offer, further sorting and processing of old scrap is carried out to increase its value. This movement of scrap from source to end-users through the chain of generation, collection, merchandising, processing and consumption is in many cases carried out within an integrated company structure. Such companies tend to specialize in one or two metals, though maintaining an active interest in all metals.

In the EEC countries the structure is quite uniform with regard to the functions performed and to the relations existing between local scrap dealers and itinerant collectors, medium size merchants and large merchants.

Scrap processing at an industrial level is carried out by medium size merchants and especially by large merchants.

Medium scrap metal trading represents the most reactive element to the scrap market economic situation, and at its level stocks may be built for speculative reasons.

The structure of the large merchant companies are either of a type integrated with industrial groups of primary and secondary metal production or independent companies having medium size merchants as partners. The overall number of large merchants operating in the EEC is estimated to be 400. It is difficult to assess how many people these companies employ because of their different structures. It is deemed there are 150 companies with more than 50 employees.

In 1970 in the United States the companies of this size were about 430 with 70 employees on average.

21.21.D - Classes of recycling companies

Many companies operate in more than one category. Table 21.2.2 is no more than a guide to some of the ways recycling companies may specialize.

21.21.E - Operations

Almost all scrap processing operations fall into one of the following categories :

- Collection
- Separation
- Upgrading
- Packaging
- Shipping

to which are to be added disposal of waste material and the general function of material handling.

Table 21.2.3 provides an analysis of the operations of scrap processors. The types of function are difficult to perform : manufacturing operations are extremely difficult, considering the wide variety in type, composition, form of raw materials, trading function, as it is necessary to find and purchase satisfactory scrap and/or solid waste at a price that will allow a profit when sold.

Table 21.2.4 gives an analysis of operations of smelters, whose problems are basically the same as for scrap processors.

Table 21.2.5 expands this functional list with specific types of equipment along with typical uses for that equipment, and a brief discussion of some of the problems and benefits associated with the type of equipment.

TABLE 21.2.2.: CLASSES OF RECYCLING COMPANIES

Class of Company	Description of Operations
Nonferrous Scrap Metal Processor	(1) Locates scrap (2) Purchases (3) Identifies (4) Sorts and separates (5) Sizes the scrap (6) Densifies (7) Markets (8) Delivers
Nonferrous Metal Broker	(1) Locates scrap sellers (2) Locates scrap customers (3) Buys (4) Markets (5) Arranges pickup and delivery (6) Stabilizes source of supply
Smelter and Refiner	(1) Buys scrap (2) Upgrades by adjusting composition and casting into ingots or pigs (3) Markets to specifications
Sweater	(1) Buys scrap (2) Upgrades by melting one metal and separating from other metals with higher melting points that remain solid (3) Casts into ingots or pigs (4) Markets
Ingot Maker	(1) Buys scrap (2) Melts selected scrap to composition and casts into ingots (3) Markets to specifications
Brass Mill	(1) Buys scrap (2) Melts selected scraps and other materials to composition and casts into ingots (3) Produces sheet, strip, and other shapes from ingots (4) Markets shapes to size and specification
Primary Metal Producer	(1) May mine ores or purchase (2) May concentrate ores or purchase (3) Upgrades concentrates by reduction to metal, adjusting composition, and casting into ingots or pigs (4) Markets to specifications (5) Sometimes also operates as secondary smelter and refiner
Scrap Iron Processor and Broker	(1) Locates scrap (2) Purchases (3) Identifies grades (4) Separates and sorts (5) Sizes the scrap (6) Densifies (7) Markets (8) Delivers (9) Often also operates as nonferrous processor or paper stock dealer
Importer and Exporter	(1) Locates domestic or foreign scrap sources (2) Locates domestic or foreign scrap customers (3) Buys (4) Markets (5) Arranges transportation
Laboratory and Assayer	(1) Analyzes materials for a fee (2) Certifies composition
Manufacturer of Equipment	(1) Designs and manufactures equipment (2) Includes equipment for recycling industry

TABLE 21.2.3. : - ANALYSIS OF SCRAP AND PROCESSOR OPERATIONS

Function	Methods
Collection of Scrap	(1) Arrangements with industrial scrap generators to buy and pick up scrap. Sometimes provides special containers and equipment at generators' plants. (2) Spot buying of scrap from factories, brokers, collectors, and other sources and picking up or arranging for delivery of the scrap. (3) Arrangements with organizations for scrap drives. (4) Buying and taking delivery of scrap brought to the processing yard by individuals, truckers, or others.
Identification and Separation of Scrap	(1) Identification and hand separation of various scrap materials from each other and from waste materials. (2) Testing of materials by chemical, spectrographic, and other analytical methods. (3) Burning-off or mechanical removal of organic materials from noncombustible scrap materials. (4) Magnetic separation of ferrous from nonferrous scrap. (5) Separation of heavy materials from light materials by air classification. (6) Separation of low melting from high melting metal scrap by selective melting. (7) Heavy media flotation of heavy from light materials. (8) Chemical solution of one material to separate from another.
Upgrading and Packaging of Scrap	(1) Reducing the size of scrap by torching, shearing, shredding, sawing, or other methods. (2) Packaging the scrap by baling, bundling, briquetting, or other methods to make handling and transportation easier and to meet customer needs. (3) Densifying scrap for ease of handling, storage, and shipment.
Delivery of Scrap	(1) Delivery to customer by owned or leased trucks or barges. (2) Delivery by public truck, rail, barge, or other forms of transportation. (3) Delivery by customer-owned or leased conveyance.
Trading	(1) Finding sources of scrap and customers for scrap. (2) Buying and selling scrap at a profit. (3) Keeping current on scrap prices. (4) Keeping up with market interrelationships, Government regulations, etc.

TABLE 21.2.4. - ANALYSIS OF SMELTER OPERATIONS

Function	Methods
Sizing of Scrap	(1) Baling of light scrap (such as wire, clippings, etc.) is sometimes done by smelters to make satisfactory furnace charging material. (2) Shearing of large pieces of scrap is sometimes done to reduce the sizes of scrap for charging to furnaces.
Upgrading of Scrap	(1) Sweating is done to remove low melting metals from higher melting inserts or attachments. (2) Fragmentizing and incineration are used to remove organic materials (such as wire insulation) from metals.
Refining	(1) Heat refining in smelting furnaces is the most widely used method of refining. (2) Electrochemical refining is used for some copper and precious metals. (3) Oxidation is sometimes done to produce metal oxides (such as zinc oxide) rather than the pure metal.
Melting	(1) Some metal scrap is not refined but merely melted and cast into pigs. The composition of the scrap must be carefully controlled since the output metal will have this same composition.
Alloying	(1) Alloying is often done in conjunction with refining. The output is then an alloy of the metal rather than the pure metal. Alloying is common for all the nonferrous metals. (2) Alloying can also be done in a simple melting operation. However, there is less choice of compositions than when alloying is done in conjunction with refining.
Analysis of Composition	(1) Analyses of scrap and recycled metals are made to determine composition for several reasons: • As a basis for pricing • To meet customer specifications • To make sure purchased scrap meets specifications • As a guide to refining procedures (2) Methods of analysis include (a) visual examination, (b) spark tests, (c) chemical tests, (d) chemical analysis, (e) spectrographic analysis. (3) Analysis is done on incoming scrap, on in-process metals, and on finished metals.
Trading	(1) Finding sources of scrap and customers for recycled metals. (2) Buying of scrap and selling of recycled metals at a profit. (3) Keeping current on scrap prices and metal prices.

TABLE 21.2.5.: IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT

Equipment	Function(s): Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping	Typical Uses	Analysis
Mobile Auto Crusher	X			X				(1) Reduce shipping volume for auto hulks. (2) Produce improved shredder feed. (3) May make auto hulk processing economical for remote areas.	(1) Appear to be gaining popularity. May be partial answer to abandoned auto problem.
Baler, Press, Briquetter			X	X				(1) Increase density of scrap for shipment. (2) Produce scrap that is easier to handle, store, and ship. (3) Produce a "sized" product.	(1) Contamination has been and continues to be a problem. Lower quality product. (2) Seems to be losing popularity to shredded scrap in many markets.
Refuse Compactors, Containers	X				X	X	X	(1) Supplier depository for raw material. (2) Material handling. (3) Part of disposal scheme for solid waste generated during processing. (4) Storage and shipment of high value scrap.	(1) Higher densities are desirable from a collection cost standpoint. (2) Reduces pilferage. (3) Prevents contamination. (4) Encourages generator segregation.
Shredder, Impact Grinder, Mill Hammermill, Crusher, Hogger, Battery Breaker, Fragmentizer		X	X	X				(1) Liberates desired raw material from other components. (Insulated wire and auto bodies for example). (2) Reduce size prior to baling. (3) Produce cleaner scrap. (4) Upgrade (turnings, etc.)	(1) This type of equipment is inherently self destructive and requires extensive maintenance both emergency and preventive. (2) This type of equipment is the heart of any scrap handling system. Much care must be taken in selecting proper model, size, etc. (3) Raw material supply is critical along with assured markets for scrap. (4) Need for lower energy mills that do not require extreme maintenance. (5) May require continuous operation to be profitable.
Shears, Torches, Saws		X	X	X				(1) Reduce size of scrap to marketable size. (2) De-package.	(1) Popular because of versatility
Scale	X					X	X	(1) Record weight of incoming and outgoing material	(1) No scrapyard can operate without scales. (2) Basis for all financial transactions on the buying

TABLE 21.2.5. : IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT (Continued)

Equipment	Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping	Typical Uses	Analysis
	Function(s)								
Conveyors, Fork Lift Trucks, Other Mobile Materials Handling Equipment					X		X	(1) Physically move raw material and scrap from one point to another. (2) Automated loading for shipment. (3) Combination of conveying and vibratory separation.	(1) Need for developments in the design of automated materials handling equipment for the scrap processing industry. (2) Has been a neglected area from technology standpoint.
Separators--Magnetic, Heavy Media, Air, Screens, Chemical		X	X					(1) Remove impurities prior to shipment. (2) Separation prior to processing to increase capacity of unit or to divert for separate processing.	(1) Most separation processes are still hand operations. (2) Offers opportunity to obtain more revenue (yield) per ton processed. (3) Special purpose separators are available but are difficult to convert to general purpose.
Furnaces--Sweat, Incinerator, Dryers		X	X	X		X		(1) Liberation of raw material from combustible components (auto body, insulated wire). (2) Separate metals by melting point. (3) Produce pigs, etc., for easier shipping, storage, analysis, etc.	(1) Sweat furnaces may be a feasible method for separating white metals from nonmagnetic auto shredder output. (2) Incineration may again become an economical method of separation as improved pollution control equipment becomes available. (3) Often violate pollution codes.
Cranes--Magnetic, Grapple					X			(1) Physically move material during processing, loading, and unloading.	(1) Magnet capacity has reached the upper limit. Any increases will now come from new technology. (2) Is an inefficient method of material handling.
Pollution Control Equipment						X		(1) Allow the use of pollution generating processing equipment.	(1) While solutions are available for most operations, they tend to be very expensive. (2) Selection of equipment often requires trial and error.

TABLE 21.2.5. : — IDENTIFICATION AND ANALYSIS OF SCRAP PROCESSING EQUIPMENT (Continued)

Equipment	Function(s): Collection	Separation	Upgrading	Packaging	Materials Handling	Disposal	Shipping	Typical Uses	Analysis
Over-the-Road Trucks	X						X	(1) Collection and shipping of material.	(1) Becoming a necessary function in many areas in order to obtain a supply of raw material. (2) A sector of the secondary materials industry is becoming service oriented.
Secondary Smelting, Melting and Other Refining Furnaces		X	X	X				(1) Removing impurities. (2) Changing physical form. (3) Producing various alloys. (4) Analyzing composition.	(1) Pollution control is necessary with most of this equipment.
Identification Equipment--file, chemicals, spectrographs, etc.	X	X				X		(1) Grade raw material and prepared scrap. (2) Establish prices. (3) Controlling specifications.	(1) Automatic identification and sorting equipment not currently available. (2) Much of this type of equipment requires a skilled operator. (3) Most identification processes are manual.
Scrap Handling Systems		X	X	X	X	X		(1) Handle entire processing operation from receipt of raw material through loading for shipment.	(1) Necessarily inflexible--requires specialization. (2) Expensive but perhaps very profitable for a high tonnage operation. (3) Assured sources of supply and markets for product are necessary.
Systems to handle municipal wastes	X	X	X	X	X	X		(1) Handle municipal solid waste as an alternative to disposal. (2) Extract marketable materials from solid waste and sell. (3) Dispose of remaining material through normal channels.	(1) Not yet economical. (2) Not yet being considered as a viable alternative to disposal. (3) Government sponsored demonstration projects currently in process and to be funded in near future should assist development of feasible systems.

21.22 - The importance of lead scrap in industry, worldwide and in EEC countries

On the basis of statistical data available and information provided by surveys conducted in the EEC member countries on behalf of the EEC by BIPE, Charter Consolidated Ltd. and ITE, the following tables have been compiled :

Tables 21.2.10 (a to i) on production and consumption of lead, and tables 21.2.11 (a to i) on domestic scrap arising, in each EEC member country and the EEC as a whole, during the period 1967 to 1976. Tables 21.2.6 to 21.2.9 have also been compiled on secondary lead production, secondary refined lead production, remelt and direct use of scrap, secondary production as a percentage of total consumption, pertaining to the EEC and to the other economic areas in the Western World for the years 1967 to 1976. Tables on total lead consumption and pertaining growth rates are included in part 2.2 "structure of consumption".

Recycling of scrap lead materials accounts for 30 to 48 per cent of total lead demand in the main industrialized areas in relationship to the pattern of consumption, growth rate and to scrap foreign trade and recycling rate.
Scrap materials contribute little in some of the less developed areas. The raw materials of the lead recycling industries are a variety of types of scrap and drosses. These materials vary from almost pure soft lead to drosses and alloys with over 25 percent impurities.
Also some lead scrap is mechanically mixed with other materials and must be separated.

The raw materials for the recycling lead industry fall into two categories : new scrap and old scrap materials. The former include lead bearing ashes, slags, drosses and residues from primary metal industries and lead manufacturing processes.
New scrap accounts for 10 % to 15 % of the scrap supply, with the present pattern of consumption.
Old scrap includes battery scrap, soft lead in sheet and pipe, cable strippings, the remainder being scrap arising from printing metals, white metal bearings.

The largest contribution to the recycling lead industry comes from the lead-acid battery sector, which accounts for 60 percent in USA and for 40 to 50 percent in EEC countries of the total recycled material.
The amount of battery scraps and its percentage on the total recycled scrap is expected to grow, the future consumption growth rate for battery lead being expected to maintain high values, equal to 4 %, while the future growth rate for total lead consumption will be around 2.5 %, owing to the decline in other uses : tetraethyl lead, cable sheathing and other minor uses. Moreover, by 1985 a recycling rate for battery scrap of 90 % to 93 % is expected.

As a consequence of the rising amount of scrap available, an increased proportion of total lead consumption, over 50 percent, will be met by the recycling industry. The need for primary lead from mines could level out and in the long run even decline.

The introduction on the market of the maintenance free batteries will not basically modify the indicated trend unless short periods do not occur during which to find a new equilibrium.

Potentially the most important factor achieved with the lead calcium or by low antimony content lead alloys (with or without catalytic regenerator) is the extension of battery life and the effect that this could in principle have on replacement battery market and the secondary lead industry. It is expected to see an average life for a high grade SLI battery in 1980 of about 5 years.

The rate of development will be limited at first, due to the industry's reluctance to make dramatic technical changes to its whole range of products, and no traumatic effects are expected on either the primary battery industry or the secondary processors. In particular, the gentle decline in the replacement market will be partially offset by the overall growth in the new battery market.
While growth in automative SLI batteries will be more gentle from now on, growth in other applications will be more rapid. The battery processors will be able to compensate for the lost antimony credit by adjusting downward their purchase price for used batteries.

The percentage of batteries recycled should not be materially affected. The antimony industry will be a sufferer from the introduction of maintenance free batteries, and it is very unlikely that growth in the overall battery market will be of much help.

Secondary lead production in the EEC countries accounts for 47 to 49 percent of the total lead consumption; secondary production from domestic scrap accounts for 43 to 45 %.
The lower values concern Italy and France while for the United Kingdom both values are around 60 %.
The excess of import secondary material as compared to the export amounts to 10 % of the domestic scrap arising.
The medium annual growth rate of the recycled material (domestic scrap arising) for 1967-1975 has been around 1 %. It will increase as a consequence of the battery scrap and the pertaining recycling rate increase, as well as of a possible increase in the recycling rate of old scrap from other uses.
For the years from 1985 to 1990 it is expected for EEC countries that secondary production from domestic scrap will account for 58 % to 61 % respectively of total lead demand.
The medium annual growth rate of the domestic arising scrap for the periods 1985/1975 and 1990/1975 could be of 5 and 4 % respectively.

TABLE 21.2.6. : SECONDARY PRODUCTION OF LEAD AS PERCENTAGE OF TOTAL CONSUMPTION

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.	94.4	75.4	88.0	98.6	83.2	86.3	99.8	87.3	115.6	57.6
Denmark	52.9	55.7	60.6	59.3	51.4	59.7	70.9	65.1	73.7	88.7
France	39.7	41.4	35.1	38.6	38.9	34.0	35.2	36.3	40.4	35.4
Germany F.R.	38.5	39.2	40.6	43.4	44.7	44.2	47.5	53.0	44.4	52.3
Ireland	-	-	-	-	-	-	-	-	-	-
Italy	24.4	26.2	21.8	24.7	27.6	26.2	34.9	33.4	44.1	32.6
Netherlands	33.5	43,8	43,8	39,7	30,0	45,1	66,4	65,6	69,7	65,7
United Kingdom	61.8	65.3	63.6	67,2	61,3	63,7	62,3	61,1	61.0	57.9
E E C	47.2	48.2	46.3	48,7	46,3	46,7	50.1	50,9	52,9	47,7
Japan	36.5	37.0	37.9	35,5	37.0	35,0	33,3	37,9	43,2	45,4
U S A	42.3	33.6	37,4	34,0	36,2	35,5	31,6	38,5	46,0	40.8
(1)	43.9	41.5	43,5	43.9	41,7	41,5	42,5	43,7	50,8	

(1) As reported by US Bureau of Mines

TABLE 21.2.7. : SECONDARY REFINED LEAD PRODUCTION - 000 TONS

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.	46.9	38.3	49.6	45.6	40.1	40.3	52.3	54.4	58.7	36.9
Denmark	9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
France	30.0	48.3	47.9	50.1	52.2	50.8	58.3	53.4	49.2	54.0
Germany F.R.	79.2	86.9	91.3	95.3	90.4	83.8	101.0	103.6	58.9	88.2
Italy	11.8	18.6	17.7	25.0	27.4	19.1	11.5	21.7	10.7	18.2
Netherlands	8.8	12.4	6.8	5.6	1.3	1.3	12.7	14.1	10.8	9.9
United Kingdom	125.9	143.6	141.6	146.7	142.8	149.6	145.0	139.9	123.4	119.3
EEC	312.5	357.8	366.9	384.3	365.6	356.9	394.2	402.0	325.4	344.5
Austria	6.0	6.0	6.0	6.7	5.8	7.8	6.6	7.5	7.4	10.0
Greece	2.7	3.7	2.4	1.8	2.9	1.6	1.0	0.1	0.1	1.1
Portugal	1.1	1.2	1.1	0.6	0.9	0.7	0.8	0.7	0.7	0.7
Spain	2.3	2.7	3.5	4.5	2.6	3.9	3.5	6.1	6.4	5.6
Sweden	16.9	10.6	12.0	9.3	18.3	18.9	18.9	22.9	18.0	20.0
Japan	28.4	30.4	30.5	30.5	29.6	31.1	35.8	37.6	42.0	60.8
U S A	123.1	111.2	122.3	128.9	112.7	140.4	136.4	172.9	195.0	169.3
Australia	26.4	29.9	32.4	32.8	30.2	29.1	30.5	32.0	33.7	31.6
TOTAL (1)	519.4	553.5	577.1	599.4	568.6	590.4	627.7	681.8	628.7	643.6

(1) Total shown concerns the reported countries only

TABLE 21.2.8. : SECONDARY PRODUCTION OF LEAD - 000 TONS

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.	52.7	42.4	50.5	55.7	45.1	49.1	60.4	62.4	66.7	44.9
Denmark	9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
France	88.2	92.7	81.5	89.6	86.8	77.8	84.4	83.1	84.7	83.9
Germany F.R.	112.6	129.8	152.8	163.6	158.6	150.3	174.1	182.2	132.0	166.7
Italy	35.8	40.6	35.7	47.0	57.4	59.1	90.3	87.3	106.8	93.2
Netherlands	20.7	27.6	32.4	29.4	22.5	32.9	49.8	46.6	43.9	42.7
United Kingdom	242.9	251.1	233.4	235.3	212.5	226.1	226.9	198.8	178.7	174.2
EEC	562.8	593.9	598.3	636.6	594.3	607.3	699.3	675.3	626.5	623.6
Japan	77.4	88.4	96.0	99.1	105.9	107.6	115.7	109.7	112.0	140.7
U S A	482.1	404.7	471.4	419.9	469.7	478.2	441.4	558.3	541.4	529.2
U S A (1)	502.4	499.7	547.9	541.9	541.4	559.4	593.6	633.8	597.3	

(1) As reported by U.S. Bureau of Mines

TABLE 21.2.9. LEAD : REMELT AND DIRECT USE OF SCRAP - 000 TONS (1)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.	5.8	4.1	0.9	10.1	5.0	8.8	8.1	8.0	8.0	8.0
France	58.2	44.4.	33.6	39.5	34.6	27.0	26.1	29.7	35.5	29.9
Germany F.R.	33.4	42.9	61.5	68.3	68.2	66.5	73.1	78.6	73.1	78.5
Italy	24.0	22.0	18.0	22.0	30.0	40.0	78.8	65.6	96.1	75.0
Netherlands	11.9	15.2	25.6	23.8	21.2	31.6	37.1	32.5	33.1	32.8
United Kingdom	117.0	107.5	91.8	88.6	69.7	76.5	81.9	58.9	55.3	54.9
EEC	250.3	236.1	231.4	252.3	228.7	250.4	305.1	273.3	301.1	279.1
Austria	2.4.	2.7	2.9	2.7	2.4	2.3	1.5	2.7	2.0	2.5
Spain					33.0	34.8	35.2	37.0	37.9	42.1
South Africa										8.0
Japan	49.0	58.0	65.5	68.6	76.3	76.5	79.9	72.1	70.0	79.9
Brasil	2.4	8.9	13.3	19.0	20.0	19.5	23.6	27.3	25.2	26.6
Canada	30.3	31.9	38.0	32.1	33.2	43.8	49.3	54.4		
U S A	359.0	293.5	349.1	291.0	357.0	337.8	305.0	385.4	346.4	359.9

(1) Calculated as difference between total and refined consumption

LEAD BALANCE SHEET 1967-1976 IN THE EEC : TABLE 21.2.10 a

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production	196.8	189.9	182.3	182.3	168.1	169.2	155.8	129.9	130.0	135.3
Net import of ores	245.0	300.9	260.9	284.5	273.1	251.2	241.8	303.1	238.7	195.5
Net import of bullion	89.7	104.6	156.2	206.9	195.7	201.9	194.5	190.7	210.4	234.9
Other materials	43.6	33.4	44.6	40.7	35.3	35.7	47.0	49.4	54.7	32.9
Apparent consumption	575.1	628.8	644.0	714.4	672.2	658.0	639.1	673.1	633.8	598.6
Primary refined lead prod. (1)	554.0	536.3	608.5	626.3	588.8	610.3	595.2	629.2	569.4	600.4
Secondary refined lead prod.	268.9	324.4	322.3	343.6	330.3	321.2	347.2	352.6	270.7	311.6
Refined lead production	822.9	860.7	930.8	969.9	919.1	931.5	942.4	981.8	840.1	912.0
Net import of refined lead	120.6	156.5	148.7	151.2	134.5	145.4	108.8	138.2	101.1	113.9
Increase in stocks –	0.8	21.4	19.1	65.4	–	26.2	–	67.0	59.0	–
Decrease in stocks +	–	–	–	–	2.2	–	29.8	–	–	3.3
Refined consumption	942.7	995.8	1,060.4	1,055.7	1,055.8	1,050.7	1,081.0	1,053.0	882.2	1,029.2
Remelt Pb-Sb Remelt lead Direct use of scrap	250.3	236.1	231.4	252.3	228.7	250.4	305.1	273.3	301.1	279.1
Total consumption	1,193.0	1,231.9	1,291.8	1,308.0	1,284.5	1,301.1	1,386.1	1,326.3	1,183.3	1,308.3
Secondary production as % of total consumption	47.2	48.2	46.3	48.7	46.3	46.7	50.1	50.9	52.9	47.7

(1) Including production from other materials (ashes, residues, mattes) which intrinsically are secondary materials but should be considered with primary metallurgy.

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN THE EEC : TABLE 21.2.11 a

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	562.8	593.9	598.3	636.6	594.3	607.3	699.3	675.3	626.5	623.6
Δ (E-I) Ashes and residues	-26.7	-24.2	-40.2	-42.8	-62.6	-49.7	-45.1	-34.5	-46.1	
Δ (E-I) Wastes and scrap	-14.5	-15.9	-20.2	-28.4	-17.7	-22.6	-42.3	-29.6	-17.0	
Domestic scrap arising	521.6	553.8	537.9	565.4	514.0	535.0	611.9	611.2	563.4	
Domestic scrap arising as % of total consumption	43.7	45.0	41.6	43.2	40.0	41.1	44.1	46.1	47.6	

LEAD BALANCE SHEET 1967-1976 IN FRANCE : TABLE 21.2.10. d

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production	27.4	26.4	30.2	28.8	29.8	26.6	25.0	23.5	21.7	28.0
Import of ores +	90.0	89.9	86.6	96.5	105.0	111.9	105.3	116.1	90.9	63.0
Export of ores −	2.4	2.5	3.0	1.4	0.7	-	-	-	5.2	-
Import of bullion +	4.9	2.8	2.8	2.6	2.0	1.7	1.2	1.3	7.8	3.8
Export of bullion −	4.0	2.4	3.4	0.7	10.0	0.7	1.8	0.3	2.2	0.6
Apparent consumption	115.9	114.2	113.2	125.8	126.1	139.5	129.7	140.6	113.0	94.2
Primary refined lead prod.	114.0	99.9	107.9	119.9	106.3	136.1	128.1	124.0	101.5	118.4
Secondary refined lead prod.	30.0	48.3	47.9	50.1	52.2	50.8	58.3	53.4	49.2	54.0
Refined lead production	144.0	148.2	155.8	170.0	158.5	186.9	186.4	177.4	150.7	172.4
Import of refined lead +	34.2	43.4	54.5	47.6	39.3	38.0	35.9	41.3	48.7	50.0
Export of refined lead −	11.9	12.2	10.9	21.4	17.0	15.9	17.3	16.3	16.2	29.2
Increase in stocks −	2.1	0.1	0.9	3.7	-	7.0	-	3.0	9.1	-
Decrease in stocks +	-	-	-	-	7.6	-	8.7	-	-	13.7
Refined consumption	164.2	179.3	198.5	192.5	188.4	202.0	213.7	199.4	174.1	206.9
Remelt Pb-Sb	5.1	4.0	5.6	7.2	5.8	3.3	6.0	6.6	7.5	
Remelt lead	7.1	6.2	4.6	4.7	6.2	9.4	11.0	10.9	9.4	29.9
Direct use of scrap	46.0	34.2	23.4	27.6	22.6	14.3	9.1	12.2	18.6	
Total consumption	222.4	223.7	232.1	232.0	223.0	229.0	239.8	229.1	209.6	236.8
Secondary production as % of total consumption	39.7	41.4	35.1	38.6	38.9	34.0	35.2	36.3	40.4	35.4

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN BELGIUM-LUX. : TABLE 21.2.11 b

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	52.7	42.4	50.5	55.7	45.1	49.1	60.4	62.4	66.7	44.9
Δ (E-I) Ashes and residues	-35.9	-26.4	-36.7	-40.6	-43.6	-26.3	-41.1	-27.8	-41.0	
Δ (E-I) Wastes and scrap	- 4.7	- 5.0	+ 0.9	- 4.5	- 3.5	- 2.4	- 1.6	- 0.2	- 5.8	
Domestic scrap arising	12.1	11.0	14.7	10.6	?	20.4	17.7	34.4	19.9	

LEAD BALANCE SHEET 1967-1976 IN DENMARK : TABLE 21.2.10 c

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production	-	-	-	-	-	-	-	-	-	-
Import of ores +	-	-	-	-	-	-	-	-	-	-
Export of ores -	-	-	-	-	-	-	-	-	-	-
Import of bullion +	-	-	-	-	-	-	-	-	-	-
Export of bullion -	-	-	-	-	-	-	-	-	-	-
Apparent consumption	-	-	-	-	-	-	-	-	-	-
Primary refined lead prod.	-	-	-	-	-	-	-	-	-	-
Secondary refined lead prod.	9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
Refined lead production	9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
Import of refined lead +	10.7	10.9	10.0	10.8	12.0	9.2	8.4	10.2	6.2	6.5
Export of refined lead -	2.3	2.8	2.2	1.2	0.6	0.7	1.7	1.9	1.3	4.0
Increase in stocks -	-	0.4	-	0.1	0.6	0.4	1.2	0.3	-	0.2
Decrease in stocks +	0.4	-	-	-	-	-	-	-	-	-
Refined consumption	18.7	17.4	19.8	27.0	22.2	20.1	18.9	22.9	18.6	20.3
Remelt Pb-Sb Remelt lead Direct use of scrap	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total consumption	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN DENMARK : TABLE 21.2.11 c

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
Δ (E-I) Ashes and residues	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	- 1.5	- 3.6	
Δ (E-I) Wastes and scrap	- 5.5	- 4.2	- 6.8	- 5.3	- 2.9	- 4.0	- 2.9	- 3.9	- 3.9	
Domestic scrap arising	4.4	5.5	5.2	10.7	8.5	8.0	10.5	9.5	6.2	

LEAD BALANCE SHEET 1967-1976 IN FRANCE : TABLE 21.2.10. d

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		27.4	26.4	30.2	28.8	29.8	26.6	25.0	23.5	21.7	28.0
Import of ores	+	90.0	89.9	86.6	96.5	105.0	111.9	105.3	116.1	90.9	63.0
Export of ores	-	2.4	2.5	3.0	1.4	0.7	-	-	-	5.2	-
Import of bullion	+	4.9	2.8	2.8	2.6	2.0	1.7	1.2	1.3	7.8	3.8
Export of bullion	-	4.0	2.4	3.4	0.7	10.0	0.7	1.8	0.3	2.2	0.6
Apparent consumption		115.9	114.2	113.2	125.8	126.1	139.5	129.7	140.6	113.0	94.2
Primary refined lead prod.		114.0	99.9	107.9	119.9	106.3	136.1	128.1	124.0	101.5	118.4
Secondary refined lead prod.		30.0	48.3	47.9	50.1	52.2	50.8	58.3	53.4	49.2	54.0
Refined lead production		144.0	148.2	155.8	170.0	158.5	186.9	186.4	177.4	150.7	172.4
Import of refined lead	+	34.2	43.4	54.5	47.6	39.3	38.0	35.9	41.3	48.7	50.0
Export of refined lead	-	11.9	12.2	10.9	21.4	17.0	15.9	17.3	16.3	16.2	29.2
Increase in stocks	-	2.1	0.1	0.9	3.7	-	7.0	-	3.0	9.1	-
Decrease in stocks	+	-	-	-	-	7.6	-	8.7	-	-	13.7
Refined consumption		164.2	179.3	198.5	192.5	188.4	202.0	213.7	199.4	174.1	206.9
Remelt Pb-Sb		5.1	4.0	5.6	7.2	5.8	3.3	6.0	6.6	7.5	
Remelt lead		7.1	6.2	4.6	4.7	6.2	9.4	11.0	10.9	9.4	29.9
Direct use of scrap		46.0	34.2	23.4	27.6	22.6	14.3	9.1	12.2	18.6	
Total consumption		222.4	223.7	232.1	232.0	223.0	229.0	239.8	229.1	209.6	236.8
Secondary production as % of total consumption		39.7	41.4	35.1	38.6	38.9	34.0	35.2	36.3	40.4	35.4

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN FRANCE : TABLE 21.2.11. d

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	88.2	92.7	81.5	89.6	86.8	77.8	84.4	83.1	84.7	83.9
Δ (E-I) Ashes and residues	+ 7.1	+ 7.8	+ 6.4	+ 5.9	+ 5.4	+ 5.1	+ 5.6	- 4.2	+ 2.2	
Δ (E-I) Wastes and scrap	+ 3.8	+ 5.4	+ 7.3	+12.1	+ 2.9	+ 0.6	+ 4.4	- 5.6	- 5.6	+ 6.3
Domestic scrap arising	99.1	105.9	95.2	107.6	95.1	83.5	94.4	73.3	81.3	
Domestic scrap arising as % of total consumption	44.6	47.3	41.0	46.4	42.6	36.5	39.4	32.0	38.8	

LEAD BALANCE SHEET 1967-1976 IN GERMANY F.R. : TABLE 21.2.10. e

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		68.0	61.3	51.5	50.0	50.1	46.2	45.4	42.7	43.0	42.1
Import of ores	+	127.2	141.7	131.4	160.6	126.4	113.8	92.0	104.0	118.5	96.6
Export of ores	-	3.4	3.2	4.6	1.2	1.6	1.0	0.4	2.3	2.1	4.4
Import of bullion	+	39.4	35.2	55.4	71.8	80.7	60.5	83.6	76.6	84.8	60.0
Export of bullion	-	1.3	1.3	0.7	1.4	3.6	4.3	1.0	3.7	1.7	0.8
Apparent consumption		229.9	233.7	233.0	279.8	252.0	215.2	219.6	217.3	242.5	193.5
Primary refined lead prod.		209.7	186.5	214.0	210.1	211.6	189.6	201.6	217.8	201.3	190.1
Secondary refined lead prod.		79.2	86.9	91.3	95.3	90.4	83.8	101.0	103.6	58.9	88.2
Refined lead production		288.9	273.4	305.3	305.4	302.0	273.4	302.6	321.4	260.2	278.3
Import of refined lead	+	40.7	52.8	55.5	53.0	43.8	57.9	49.1	47.4	32.8	45.0
Export of refined lead	-	76.0	39.1	36.1	48.0	59.8	56.8	62.1	80.2	73.6	65.8
Increase in stocks	-	-	-	10.0	1.5	-	1.0	-	23.4	-	17.0
Decrease in stocks	+	5.8	1.1	-	-	0.5	-	4.1	-	5.1	-
Refined consumption		259.4	288.2	314.7	308.9	286.5	273.5	293.7	265.2	224.5	240.5
Remelt Pb-Sb Remelt lead	}	23.4	32.8	46.5	49.8	49.9	51.6	56.4	62.1	59.6	62.4
Consumption		282.8	321.0	361.2	358.7	336.4	325.1	350.1	327.3	284.1	302.9
Direct use of scrap		10.0	10.1	15.0	18.5	18.3	14.9	16.7	16.5	13.5	16.1
Total consumption		292.8	331.1	376.2	377.2	354.7	340.0	366.8	343.8	297.6	319.0
Secondary production as % of total consumption		38.5	39.2	40.6	43.4	44.7	44.2	47.5	53.0	44.4	52.3

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN GERMANY F.R. : TABLE 21.2.11. e

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	112.6	129.8	152.8	163.6	158.6	150.3	174.1	182.2	132.0	166.7
Δ (E-I) Ashes and residues	- 1.8	- 6.7	-10.1	- 6.6	- 3.0	- 6.2	- 5.3	- 2.6	- 3.6	
Δ (E-I) Wastes and scrap	+13.2	+ 0.9	- 9.9	- 8.1	+ 1.6	- 1.6	-11.7	-14.3	+ 5.7	- 1.5
Domestic scrap arising	124.0	124.0	132.8	148.9	157.2	142.5	157.1	165.3	134.1	
Domestic scrap arising as % of total consumption	42.3	37.5	35.3	39.5	44.3	41.9	42.8	48.1	45.1	

LEAD BALANCE SHEET 1967-1976 IN IRELAND : TABLE 21.2.10. f

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		59.5	62.2	59.9	64.2	51.6	59.6	56.2	37.7	36.3	32.6
Import of ores	+	-	-	-	-	-	-	-	-	-	-
Export of ores	-	57.0	65.0	62.0	64.0	50.0	53.0	54.0	35.0	30.0	30.0
Import of bullion	+	-	-	-	-	-	-	-	-	-	-
Export of bullion	-	-	-	-	-	-	-	-	-	-	-
Refined lead production		-	-	-	-	-	-	-	-	-	-
Refined consumption		1.2	1.2	1.2	1.0	1.0	1.2	2.0	1.7	1.7	2.3

LEAD BALANCE SHEET 1967–1976 IN ITALY : TABLE 21.2.10. g

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		38.7	36.5	37.0	35.2	31.6	33.7	25.9	23.3	25.5	30.1
Import of ores	+	13.6	31.6	20.1	20.8	18.3	16.1	25.0	39.7	8.9	13.0
Export of ores	–	2.2	2.2	4.9	8.6	9.6	15.4	7.7	8.1	13.1	17.6
Import of bullion	+	2.0	2.3	0.8	1.1	19.7	30.9	4.5	3.0	9.8	9.4
Export of bullion	–	–	–	–	–	–	–	–	0.4	–	3.7
Apparent consumption		52.1	68.2	53.0	48.5	60.0	65.3	47.7	57.5	31.1	31.2
Primary refined lead prod.		60.5	57.6	62.3	54.3	48.5	50.1	35.1	43.5	33.2	46.0
Secondary refined lead prod.		11.8	18.6	17.7	25.0	27.4	19.1	11.5	21.7	10.7	18.2
Refined lead production		72.3	76.2	80.0	79.3	75.9	69.2	46.6	65.2	43.9	64.2
Import of refined lead	+	54.5	52.0	63.0	118.1	98.9	117.4	131.1	156.3	115.3	142.2
Export of refined lead	–	–	–	–	–	–	0.2	1.8	1.6	3.4	0.4
Increase in stocks	–	3.8	–	–	29.4	–	0.4	–	24.5	9.9	–
Decrease in stocks	+	–	4.8	3.0	–	3.2	–	4.3	–	–	5.0
Refined consumption		123.0	133.0	146.0	168.0	178.0	186.0	180.2	195.4	145.9	211.0
Remelt Pb-Sb								53.8	46.6	46.1	54.0
Remelt lead		24.0	22.0	18.0	22.0	30.0	40.0	25.0	19.0	50.0	21.0
Direct use of scrap											
Total consumption		147.0	155.0	164.0	190.0	208.0	226.0	259.0	261.0	242.0	286.0
Secondary production as % of total consumption		24.4	26.2	21.8	24.7	27.6	26.2	34.9	33.4	44.1	32.6

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN ITALY : TABLE 21.2.11. g

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	35.8	40.6	35.7	47.0	57.4	59.1	90.3	87.3	106.8	93.2
Δ (E-I) Ashes and residues	+ 0.1	- 1.9	- 1.8	- 2.8	- 6.1	-12.9	- 2.2	+ 1.6	- 0.3	+ 8.2
Δ (E-I) Wastes and scrap	-22.7	-14.2	-15.2	-23.3	-14.8	-15.6	-15.2	-21.9	-13.8	-16.7
Domestic scrap arising	13.2	24.5	18.7	20.9	36.5	30.6	72.9	67.0	92.7	84.7
Domestic scrap arising as % of total consumption	9.0	15.8	11.4	11.0	17.5	13.5	28.1	25.7	38.3	29.6

LEAD BALANCE SHEET 1967-1976 IN THE NETHERLANDS : TABLE 21.2.10. h

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		-	-	-	-	-	-	-	-	-	-
Import of ores	+	-	-	-	-	-	-	-	-	-	-
Export of ores	-	-	-	-	-	-	-	-	-	-	-
Import of bullion	+	6.1	5.1	8.0	12.3	22.3	20.7	12.6	13.6	13.1	12.0
Export of bullion	-	-	-	-	-	-	-	-	1.3	-	-
Apparent consumption		6.1	5.1	8.0	12.3	22.3	20.7	12.6	12.3	13.1	12.0
Primary refined lead prod.		6.1	5.1	8.0	12.3	22.3	20.7	12.6	12.3	13.1	12.0
Secondary refined lead prod.		8.8	12.4	6.8	5.6	1.3	1.3	12.7	14.1	10.8	9.9
Refined lead production		14.9	17.5	14.8	17.9	23.6	22.0	25.3	26.4	23.9	21.9
Import of refined lead	+	46.2	46.9	49.0	45.9	47.8	39.5	37.1	30.7	28.4	32.0
Export of refined lead	-	10.7	16.2	13.6	14.1	17.0	21.4	24.4	19.5	23.9	22.2
Increase in stocks	-	0.5	0.4	1.8	-	0.6	-	0.1	-	-	-
Decrease in stocks	+	-	-	-	0.5	-	1.3	-	0.9	1.5	0.5
Refined consumption		49.9	47.8	48.4	50.2	53.8	41.4	37.9	38.5	29.9	32.2
Remelt Pb-Sb Remelt lead Direct use of scrap		11.9	15.2	25.6	23.8	21.2	31.6	37.1	32.5	33.1	32.8
Total consumption		61.8	63.0	74.0	74.0	75.0	73.0	75.0	71.0	63.0	65.0
Secondary production as % of total consumption		33.5	43.8	43.8	39.7	30.0	45.1	66.4	65.6	69.7	65.7

LEAD: SCRAP ARISING FROM DOMESTIC SOURCES IN THE NETHERLANDS : TABLE 21.2.11. h

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	20.7	27.6	32.4	29.4	22.5	32.9	49.8	46.6	43.9	42.7
Δ (E-I) Ashes and residues	+ 3.8	+ 3.0	+ 2.0	+ 1.3	- 8.1	- 2.8	+ 0.1	- 0.2	- 1.1	
Δ (E-I) Wastes and scrap	+ 3.4	+ 2.5	+ 4.4	+ 3.8	+ 0.9	+ 2.3	-11.7	+ 0.8	- 5.4	
Domestic scrap arising	27.9	33.1	38.8	34.5	15.3	32.4	38.2	47.2	37.4	
Domestic scrap arising as % of total consumption	45.1	52.5	52.4	46.6	20.4	44.4	50.9	66.5	59.4	

LEAD BALANCE SHEET 1967-1976 IN THE UNITED KINGDOM : TABLE 21.2.10. i

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		3.2	3.5	3.7	4.1	5.0	3.1	3.3	2.7	3.5	2.5
Import of ores	+	24.9	50.0	46.9	35.4	43.0	22.8	30.6	42.6	29.6	12.7
Export of ores	-	-	-	-	-	-	-	-	-	-	-
Import of bullion	+	68.3	95.7	123.2	158.6	124.4	114.1	126.7	127.3	116.9	164.5
Export of bullion	-	25.7	34.0	32.3	39.7	41.5	22.1	31.0	24.5	24.6	16.3
Apparent consumption		70.7	115.2	141.5	158.4	130.9	117.9	129.6	148.1	125.4	163.4
Primary refined lead prod.		65.8	92.0	118.9	140.3	120.8	121.0	120.1	137.0	117.9	132.2
Secondary refined lead prod.		125.9	143.6	141.6	146.7	142.8	149.6	145.0	139.9	123.4	119.3
Refined lead production		191.7	235.6	260.5	287.0	263.6	270.6	265.1	276.9	241.3	251.5
Import of refined lead	+	114.8	119.1	106.0	96.9	105.8	91.6	87.1	84.5	82.3	68.4
Export of refined lead	-	39.8	60.1	94.4	97.6	89.1	95.9	86.6	92.1	55.0	60.8
Increase in stocks	-	-	17.8	-	24.6	3.6	-	-	2.9	30.8	13.0
Decrease in stocks	+	9.6	-	3.2	-	-	12.1	16.6	-	-	-
Refined consumption		276.3	276.8	275.3	261.7	276.7	278.4	282.2	266.4	237.8	246.1
Remelt Pb-Sb Remelt lead Direct use of scrap		117.0	107.5	91.8	88.6	69.7	76.5	81.9	58.9	55.3	54.9
Total consumption		393.3	384.3	367.1	350.3	346.4	354.9	364.1	325.3	293.1	301.0
Secondary production as % of total consumption		61.8	65.3	63.6	67.2	61.3	63.7	62.3	61.1	61.0	57.9

LEAD: **SCRAP ARISING FROM DOMESTIC SOURCES IN THE UNITED KINGDOM : TABLE 21.2.11 i**

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	242.9	251.1	233.4	235.3	212.5	226.1	226.9	198.8	178.7	174.2
Δ (E-I) Ashes and residues	n.a.	n.a.	n.a.	n.a.	- 7.2	- 6.6	- 2.2	+ 0.2	+ 1.3	
Δ (E-I) Wastes and scrap	- 2.0	- 1.3	- 0.9	- 3.1	- 1.9	- 1.9	- 3.6	+15.5	+11.8	+ 6.0
Domestic scrap arising	240.9	249.8	232.5	232.2	203.4	217.6	221.1	214.5	191.8	
Domestic scrap arising as % of total consumption	61.3	65.0	63.3	66.3	58.7	61.3	60.7	65.9	65.4	

21.23 - Secondary lead flow in industry

Little new scrap is produced by the lead industry for sale through the scrap route.
The battery manufacturers produce drosses and residues, estimated to be 10 % of the weight of material handled.
The alkyl lead manufacturers produce a residue estimated to be 10 % of the weight of lead handled.
New pipe, sheet and cable scrap is very restricted.

New scrap includes residues and drosses from melting and metallurgical processes.
Some of the material is returned to the smelters from whom the manufacturer buys his lead and alloys, and is in effect "in house" recycling.
Overall new scrap is estimated 11 % of total recycled scrap.

Old scrap is therefore the basic material of the secondary lead industry.

The amount and the average composition of new and old scrap built up in EEC countries during the period 1973-1975 is illustrated hereunder :

		1973 - 1975	
		tons	%
New Scrap			
Alkyl lead		8 000	1.40
Batteries		25 000	4.30
Residues-ashes		21 000	3.60
Other metallics		11 000	1.90
	Sub Total	65 000	11.20
Old Scrap			
Cable sheathing		75 000	12.90
Alloys		35 000	6.00
(Solder 90 %)			
(Bearings 10 %)			
Other obsolete		150 000	25.80
Batteries		255 000	44.00
SLI			
Traction			
Stationary			
	Sub Total	515 000	88.80
	TOTAL	580 000	100.00

The industry is able to assimilate only a portion of raw scrap as the major users require high purity material. The sheet and pipe manufacturers are limited in some countries by Standard Specifications; similarly, the cable sheathing manufacturers are also limited by Standard to various exact grades of lightly alloyed lead. The lead chemical industry and the manufacturers of anti-knock compounds require a very high purity lead, and usually only use primary refined lead for technical reasons.

Secondary antimonial lead from selected battery scrap or refined lead are used for battery manufacturers.
Secondary antimonial lead is used for shot manufacturers.
The percentage of scrap which is refined either to soft lead or a fixed alloy composition varies from country to country.

Scrap processing

Depending on its composition, scrap can be treated according to one of the following methods :

- Smelting

  Lead compounds such as those in batteries, have to be smelted to produce an impure lead which requires further refining before it can be used. This process can also produce antimonial lead from selected scrap.

- Refining

  Scrap metallic soft lead, such as plumbing and sheathing lead from the demolition of buildings and chemical plants, and the lead from smelters, are refined by processes similar to those used for refining primary lead, i.e. by the use of sulphur to remove copper and oxidation to lower the tin, arsenic and antimony contents. Alloys are then made from the lead by adding the appropriate element additions.

- Remelting

  Some metallic scrap, such as pure sheet and cable strippings, is simply remelted and cast into ingot form but the quantity is relatively small (16 000 tons per year). The majority then goes to refiners.

Soft lead, mainly from sheet and pipe, is easy to melt and refine. It is often remelted by a merchant and then either sold to a refiner or sold directly to a customer, where it is used as a low purity lead for various miscellaneous uses including the production of yacht keels and weights.

Ashes and residues of lead are smelted and refined to produce secondary refined lead.

Lead alloys are sold below the value of the metals they contain. Although the discount is not great, it is sufficient to make it uneconomic for the primary refiners to compete in this market by making up the same alloy from primary materials. At the same time, the discounts are sufficient to make profitable the extraction of pure metals from purchased alloys or scrap. The result is that lead alloys are recycled by secondary refiners essentially for the production of alloys of similar composition.

Lead cable sheathing is lightly alloyed with tin and antimony. The scrap material contains copper as an impurity which is extracted as a valuable by-product during refining. Cable alloy scrap is sometimes used in a mixed feed for refining to soft lead, but more usually the tin and antimony content is retained and the melt is simply refined for the production of cable alloy. The melt is heated to yield a tin and antimony content below target assay and then adjusted back with antimonial lead and solder.

Printing metal is frequently refined and recycled as printing metal after the composition has been adjusted. This is often done on a toll basis.
The off-grade slightly oxidized material is refined to remove copper, zinc and arsenic, and the tin and antimony content is corrected by additions of solder and high antimonial lead. The large arisings of unwanted printing metal, due to the substitution by other techniques and materials, have been utilized as lead-tin-antimony alloys in solder production.

Similarly, whitemetal bearings which also contain tin and antimony are recycled by direct use for solder production.

The recovery of the lead content in used batteries is by far the most important activity of the secondary lead industry.

While mechanical processes are in use for the breaking of batteries, i.e. STOLBERG and TONOLLI, hand breaking is still commonly used even though it is messy and unpleasant. Problems exist in the discard of any remaining acid as well as the plastic-based material of the outer case, though with good industrial practice such materials can be separated out and disposed of under controlled conditions.
The metal/oxide mixture separated from the batteries is then smelted in a two stage process to yield crude soft lead and crude antimonial lead. This is effected by carefully controlling the atmospheric conditions in the furnace. In the first stage, furnace conditions are held oxidizing to antimony but neutral to lead; in the second stage, conditions reducing to both lead and antimony are the rule. The processing can be carried out either in a rotary or a reverberatory type furnace.

A new technique for handling and treating battery scrap is now available. In Denmark a new smelter has been put in operation to smelt unbroken batteries, even up to 100 % of the charge. The process guarantees full control on pollution of the atmosphere or the surrounding district. With this process a one grade antimonial lead is produced.
In comparison to the tonnage of secondary lead arising from used batteries, the other sources of secondary lead are small in tonnage though with higher lead values. Tinny materials such as lead-tin-antimony-alloys, solder dross, printing metal dross, whitemetal are examples of this category.

The two main series of lead-tin-antimony alloys are :

	Sn	Sb	Pb
Printing metals	2 - 15 %	3 - 20 %	Balance
Solders	18 - 65 %	0 - 3½ %	Balance

Summing up, the utilization of lead scrap tends to follow a fairly well defined pattern. Soft lead scrap arisings including ashes and residues are recycled as secondary refined lead or remelted low purity lead. Whenever possible alloy scrap is recycled as an alloy, making full use of the contained alloying elements.

Antimonial battery lead scrap, cable alloy and printing metals scrap are frequently recycled for use in the same industry while excess printing metal, whitemetal bearings are recycled as Pb-Sn-Sb alloys in solder production.

21.24 - Scrap availability in EEC countries and future availability (lead)

Domestic arising scrap for the EEC countries amounts on the average to 550 000 tons, with peaks of 580 000 tons, and 610 000 tons in 1973 and 1974 respectively. It is constituted by 11-12 % of new scrap.

Batteries scrap account for 45-55 % of old scrap.

Availability of scrap also depends on the recycling rate which, in the case of old scrap, is defined as the ratio of lead recycled to lead available in obsolete products.

With present technology and under traditional economic factors, lead used in tetraethyl lead, oxydes and chemicals, ammunition, is not recoverable and there is no chance in future recycling.

- Battery Lead

The trade-in system on batteries scrap collection, the short-cut from the automobile to the smelter, and the present scrap processing - Stolberg, Bleiberg, Tonolli - system, and the new Bergsoe process will allow a recycling rate of 90 % to 93 % by 1985.

- Cable sheathing

A survey conducted by Battelle Memorial Institute (Battelle Memorial Institute EPA-SW-4D-I 72) indicates a recovery rate of 25 %, which is not justified if we consider that the recovery on the basis of copper and lead values is economically active.

It is admitted that some mistakes in collecting data may occur.

The limited recovery rate is in contrast with the reported higher rates of recovery of copper from cables.

The survey indicates as a goal a recovery of 90 %.

For the electric sector, the medium recovery rate of copper from obsolete products is reported to be of 68 % or 60 % according to the different authors.

In this sector, aerial and lead insulated cables are featured by the highest collection rate.

In Italy, public companies operating in the field of electric power distribution and telecommunications effect the total recovery of cables.
Even for cables, it is possible to reach a segregation rate higher than 90 %.
For these reasons we indicated for cable sheathing a recycling rate of 70 %.

- Solders

It is difficult to make evaluations since the alloy is applied in small quantities to larger quantities of other metals (copper, steel). Thus, collection of this lead for recycling is a side line to collection of the other metals to which the lead is attached. In some cases, it is separated and recovered as lead, in others as a by-product of the main metal.
The possibility of total recovery of lead (and tin) contained in solders of copper and brass products has been confirmed by the experts of an important industry operating in the field of secondary metallurgy.
Separation of lead from steel by means of physical processing - salt sweating, cryogenic technique - or recovery of lead as flue dust is accomplished technologically as well as industrially.
Thus, a recovery rate of 50 % is assumed.

- Other obsolete lead scrap

Considerable lead is used for its corrosion resistance in pipe, fittings, and sheet; in foil and collapsible tubes; as caulking; in weights and ballasts; and for several minor uses such as ternemetal, lead plating, annealing and galvanizing.
Overall, the recycling rate is already high (60 %) and a goal of 70 % can be envisaged.

- Type metal

Recycling rate 100 percent.

Future scrap availability in 1985 and in 1990 has been calculated on the basis of past level consumption and the life expectancy of the various lead products and of the above predicted recycling rate, where statistic data have been available : batteries, alloys and other obsolete. Forecasts concerning cable sheathing have been based on the consumption reported for the UK, while for the other countries the percentage of cable sheathing on total lead consumption has been roughly estimated. Tables 21.2.12 and 21.2.13 indicate the basic data used and quantities of lead recycled from the various obsolete materials in the period 1973-1975, as from surveys conducted for the Community, and for the period 1985-1990, as from the available data and forecasts on consumption of 1985-1990.

TABLE 21.2.12

Source	Life cycle (years)	Recycling rate	Years of lead consumption to be used to calculate lead availability	
			1985	1990
Cable sheathing	30/40	70	1945	1950
Alloys:				
Solders (90%)	20	50	1965	1970
Bearing metal (10%)	20	30	1965	1970
Other obsolete scrap	30	70	1955	1960
Batteries SLI (80%)	5	90	1980	1985
Traction (10%)	5	90	1980	1985
Stationary (10%)	20	90	1965	1970

TABLE 21.2.13 SCRAP AVAILABILITY

(Tons of Lead Recycled)

Source	1973 - '75	1 9 8 5	1 9 9 0
	tonn.	tonn.	tonn.
NEW SCRAP			
Tetraethyl lead	8.000	8.000	8.000
Batteries	25.000	40.000	40.000
Ashes and residues	21.000	24.000	25.000
Other metallics	11.000	8.000	7.000
Sub Total	65.000	80.000	80.000
OLD SCRAP			
Cable sheathing	75.000	120.000	140.000
Alloys :			
Solders (90%) Bearings (10%)	35.000	30.000	30.000
Other obsolete	150.000	175.000	200.000
Batteries	255.000	520.000	575.000
S L I		(450.000)	(485.000)
Traction		(45.000)	(60.000)
Stationary		(25.000)	(30.000)
Sub Total	515.000	845.000	945.000
TOTAL	580.000	925.000	1.025.000

21.25 - The importance of zinc scrap in industry, worldwide and in EEC countries

On the basis of statistical data available and information provided by surveys conducted in the EEC member countries on behalf of the EEC by BIPE, Charter Consolidated and ITE, the following tables have been compiled :

- Table 21.2.14 on secondary zinc production during the period 1967-1976;
- Table 21.2.15 on secondary zinc production as percentage of total consumption in selected countries, during the period 1967-1976;
- Tables 21.2.16 (a to i) on production and consumption of zinc in each EEC member country and in the EEC as a whole, during the period 1967-1976;
- Tables 21,2.17 (a to i) on domestic scrap arising in each EEC member country during the period 1967-1976.

Tables on total zinc consumption and pertaining growth rates are included in part 2.2 "structure of consumption".

Recycling of scrap zinc materials accounts for 23 % of total zinc demand in the main industrialized areas in relation to the pattern of consumption, growth rate, scrap recycling rate, and foreign trade.

In the four main EEC countries secondary zinc production accounts for 28 % of total consumption, while secondary production from domestic source accounts for 26 % of total consumption.

The proportion of recycled zinc in total consumption is lower than that of other main non-ferrous metals - aluminium, copper, lead - for two basic reasons :

i) the large extent to which zinc is employed in dissipative uses;

ii) the wide dispersion of old scrap and the consequent problem of economic retrieval.

The major dissipative uses of zinc are in galvanizing, paints, cathodes for galvanic protection or agricultural products : during product life, the zinc is consumed and cannot be recycled. In other applications, such as zinc oxide and certain chemicals, the zinc is not dissipated but cannot be recovered economically with present technology.

Other zinc products, including brass mill products, zinc alloys and rolled zinc products, are recycled, but become available only after the life cycles of the products are exhausted.

The recycling rate of old scrap, i.e. the ratio of zinc recycled to zinc available in obsolete products, is after all very low under the present methods of collection and recycling technology.

SECONDARY ZINC PRODUCTION - '000 TONS : TABLE 21.2.14

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
By primary zinc smelters										
France	24.7	24.0	22.9	27.7	23.7	22.9	39.1	35.9	31.5	19.9
Germany F.R.	45.7	51.0	59.3	67.0	55.7	67.3	64.5	66.6	65.0	65.0
Japan	4.0	3.7	4.8	4.4	3.4	4.2	1.1	0.9	0.1	-
USA	65.9	71.3	62.3	68.4	72.4	66.9	75.5	71.2	52.5	57.7
TOTAL (1)	140.3	150.0	149.3	167.5	155.2	161.3	180.2	174.6	149.1	142.6
Remelted zinc and remelted zinc alloys										
Germany F.R.	45.0	54.0	57.0	58.0	66.0	70.0	75.0	65.0	60.0	65.0
France (2)	33.5	34.3	24.9	27.0	52.0	51.0	58.0	55.0	39.0	33.8
Italy	11.5	12.0	12.0	15.0	17.0	18.0	22.0	16.0	16.0	21.0
United Kingdom	6.6	8.9	7.4	5.5	7.7	8.5	7.1	6.2	4.4	5.1
Austria	1.4	1.3	1.5	2.8	0.8	0.6	0.6	0.3	0.4	0.6
Sweden	0.7	0.4	0.7	0.6	0.5	0.4	0.5	1.3	0.1	0.5
EUROPE (1)	98.7	110.9	103.5	108.9	144.0	148.5	163.2	143.8	119.9	126.0
ASIA (Japan)	14.7	19.1	18.0	22.1	22.0	23.3	24.9	23.3	23.6	34.0
Brazil	-	-	-	3.4	3.7	3.7	4.4	5.4	8.0	10.0
Canada	3.4	6.4	3.1	3.4	1.4	2.0	4.7	4.0	3.5	4.0
USA remelted zinc	5.8	5.0	5.1	3.8	1.9	6.1	1.6	1.6	1.4	2.9
zinc alloys	15.7	15.9	18.1	17.9	22.1	15.0	14.8	14.3	8.7	10.3
AMERICA	24.9	27.3	26.3	28.5	29.1	26.8	25.5	25.3	21.6	27.2
AUSTRALIA	4.8	4.7	6.5	7.9	7.0	8.7	7.0	7.0	7.0	7.0
TOTAL	143.1	162.0	154.3	167.4	202.1	207.3	220.6	199.4	172.1	194.2
Zinc in copper and other alloys										
United Kingdom	41.3	45.8	51.0	47.6	41.7	43.9	47.0	44.6	36.4	35.7
Japan	40.0	45.0	45.0	50.0	50.0	50.0	55.0	45.0	40.0	50.0
USA copper alloys	132.8	148.3	178.0	147.0	156.0	174.8	163.9	134.9	132.5	106.3
other alloys	5.9	6.0	6.6	6.1	6.5	7.3	7.7	7.6	0.7	0.6
Other countries	100.0	110.0	110.0	120.0	120.0	120.0	130.0	130.0	110.0	125.0
TOTAL	320.0	355.1	390.6	370.7	374.2	396.0	403.6	362.1	319.6	317.6
Scrap as such, used by chemical etc. plants										
United Kingdom	33.1	34.0	35.0	39.4	34.9	33.6	35.4	33.8	28.4	27.1
Japan	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	9.0
USA	64.1	75.3	71.4	64.8	67.0	81.8	84.2	77.4	61.1	66.9
Other countries	65.0	65.0	65.0	70.0	70.0	70.0	80.0	80.0	70.0	80.0
TOTAL	172.2	184.3	181.4	184.2	181.9	195.4	209.6	201.2	167.5	183.0
Secondary zinc production in Western World	775.6	851.4	875.6	889.8	913.4	960.0	1,014.0	937.3	808.3	837.4

(1) Total shown concerns the reported countries only
(2) New reporting basis from 1971

SECONDARY ZINC PRODUCTION AS PERCENTAGE OF TOTAL CONSUMPTION : TABLE 21.2.15

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
France	40.7	39.2	29.2	34.5	31.3	25.7	33.5	26.9	34.7	26.3
Germany	34.2	28.5	28.3	26.9	27.7	26.3	27.6	30.4	36.1	37.2
Italy	23.7	23.4	23.9	23.8	28.7	22.8	23.3	27.9	36.3	31.9
United Kingdom	23.6	24.0	24.6	25.3	23.9	22.6	22.6	22.8	24.9	21.3
Total	31.2	28.9	26.8	27.6	27.7	24.5	27.0	27.1	33.2	29.8
Japan	13.0	13.0	11.6	12.3	12.1	10.9	10.1	10.2	11.6	11.7
USA (1)	15.4	15.8	17.0	16.7	16.9	16.7	15.5	15.4	18.2	14.1

(1) Recoverable zinc content

ZINC BALANCE SHEET 1967-1976 IN THE EEC : TABLE 21.2.16 a

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production	322.3	362.4	407.1	386.6	373.4	363.7	315.5	305.6	306.5	332.3
Net import of ore	602.7	639.9	715.0	725.5	774.7	764.5	931.0	1,056.4	913.6	918.7
Apparent consumption	925.0	1,002.3	1,122.1	1,112.1	1,148.1	1,128.2	1,246.5	1,362.0	1,220.1	1,251.0
Slab production	823.8	956.4	1,116.3	1,092.4	987.2	1,153.4	1,226.8	1,324.5	1,043.1	1,130.4
Net import of slab	224.4	221.7	230.0	208.6	235.0	133.5	138.2	158.0	51.7	8.6
Increase in stock -	-	10.9	51.5	47.2	-	-	-	73.9	72.7	-
Decrease in stock +	11.5	-	-	-	15.0	67.5	118.7	-	-	68.4
Slab consumption	1,059.7	1,167.2	1,294.8	1,253.8	1,237.2	1,352.6	1,483.7	1,408.6	1,022.1	1,207.4
Net import of zinc alloys	12.8	12.6	15.2	21.3	16.0	22.9	14.3	9.3	10.7	24.5
Direct use of scrap	320.6	322.8	296.8	315.6	310.9	285.7	333.6	295.1	331.7	379.2
Total consumption	1,393.1	1,502.6	1,606.8	1,590.7	1,564.1	1,661.2	1,831.6	1,713.0	1,364.5	1,611.1
Secondary production as % of total consumption for the main EEC countries	31.2	28.9	26.8	27.6	27.7	24.5	27.0	27.1	33.2	29.8

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN THE EEC : TABLE 21.2.17 a

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
MAIN EEC COUNTRIES (1)										
Secondary production	380.4	377.2	373.8	378.8	378.8	354.4	428.2	396.1	393.6	416.9
Δ (E-I) Brass ingots	+ 7.0	+ 3.4	+ 2.0	+ 0.9	+ 0.9	+ 2.1	+ 3.1	- 0.8	+ 2.7	
Δ (E-I) Ashes and residues	+ 1.2	- 4.0	-10.5	+ 1.3	+29.9	+32.7	-23.9	+10.6	-25.9	
Δ (E-I) Zinc scrap	-21.2	-21.1	-18.1	-15.9	-19.2	-18.2	-19.6	-18.4	-10.3	
Δ (E-I) Brass scrap	- 9.1	-16.5	-19.7	-19.6	-11.2	-11.7	-21.6	-19.9	-12.9	
Domestic arising scrap	358.3	339.0	327.5	345.5	379.2	359.3	366.2	367.6	347.2	
Domestic arising scrap as % of total consumption	29.4	25.9	23.4	25.2	27.7	24.9	23.1	25.2	29.3	
Estimated domestic scrap arising in:										
Belgium-Lux.								(2)36.0		
Netherlands								(3)18.0		
Denmark								(3) 7.0		
Ireland								(2) 1.2		
Total EEC								429.8		

(1) Germany F.R.; France; Italy; United Kingdom
(2) As reported by Charter Consolidated Ltd.
(3) As reported by ITE

ZINC BALANCE SHEET 1967-1976 IN BELGIUM-LUX. : TABLE 21.2.16 b

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		-	-	-	-	-	-	-	-	-	-
Imports of ore	+	276.0	267.4	250.0	205.0	256.2	233.0	284.0	253.0	262.7	234.8
Exports of ore	-	14.1	26.2	29.3	30.0	11.9	30.3	26.6	34.4	11.3	20.0
Apparent consumption		261.9	241.2	220.7	175.0	244.3	202.7	257.4	218.6	251.4	214.8
Slab production (1)		223.8	247.3	257.4	232.6	209.1	255.6	277.7	288.8	218.2	236.1
Imports of slab	+	14.2	20.0	41.7	29.2	35.0	39.3	67.0	69.6	23.9	29.1
Exports of slab	-	136.2	151.4	155.5	137.3	126.8	192.6	221.7	193.6	180.2	188.0
Increase in stock	-	-	-	-	-	-	-	-	-	-	-
Decrease in stock	+	14.0	2.7	6.8	3.0	13.6	36.9	57.1	30.1	41.4	42.3
Slab consumption		115.8	118.6	150.4	127.5	130.9	139.2	180.1	194.9	103.3	119.5
Direct use of scrap		10.1	18.2	n.a.	21.0	1.6	17.2	n.a.	n.a.	26.0	34.6
Total consumption		125.9	136.8	150.4	148.5	132.5	156.4	180.1	194.9	129.3	154.1

(1) Including some remelted zinc

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN BELGIUM-LUX. : TABLE 21.2.17 b

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	13.6	22.0	4.2	30.3	6.4	22.7	4.4	4.7	32.7	41.0
Δ (E-I) Brass ingots	n.a.	n.a.	+0.9	+ 0.7	+ 0.9	+ 0.2	+ 0.3	+ 0.4	+ 0.8	+0.6
Δ (E-I) Ashes and residues	-23.3	-7.7	+0.7	-12.9	-15.0	-21.5	- 1.6	-43.5	-25.5	
Δ (E-I) Zinc scrap	+ 6.3	+7.0	+7.0	+ 6.6	+ 2.6	+ 5.5	+ 4.7	- 3.1	- 9.6	
Δ (E-I) Brass scrap	- 4.6	-9.9	-9.8	-13.8	- 6.9	- 5.5	-10.5	- 9.7	- 8.5	

N.B. Statistical data do not allow a correct calculation of the total of secondary production and domestic arising scrap

ZINC BALANCE SHEET 1967-1976 IN DENMARK : TABLE 21.2.16 c

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		-	-	-	-	-	-	-	-	-	-
Import of ore	+	-	-	-	-	-	-	-	-	-	-
Export of ore	-	-	-	-	-	-	-	-	-	-	-
Slab production		-	-	-	-	-	-	-	-	-	-
Imports of slab	+	8.0	10.1	11.9	13.5	8.8	13.1	13.1	13.4	11.2	10.2
Exports of slab	-	0.1	0.2	-	0.1	0.2	0.1	-	0.3	0.1	0.1
Increase in stock	-	-	0.2	0.1	1.0	-	0.1	0.3	0.1	0.3	-
Decrease in stock	+	-	-	-	-	1.3	-	-	-	-	-
Slab consumption		7.9	9.7	11.8	12.4	9.9	12.9	12.8	13.0	10.8	10.1

ZINC BALANCE SHEET 1967-1976 IN FRANCE : TABLE 21.2.16 d

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		24.9	21.8	20.1	18.6	15.1	13.3	13.3	14.3	13.9	34.7
Import of ore	+	174.4	209.1	240.0	238.4	223.3	253.2	269.8	297.7	233.2	241.1
Export of ore	–	0.1	15.8	7.0	2.8	–	2.7	5.2	10.4	10.3	10.1
Apparent consumption		199.2	215.1	253.1	254.2	238.4	263.8	277.9	301.6	236.8	265.7
Slab production		185.7	207.5	253.5	223.7	218.7	261.5	257.8	276.7	181.1	233.5
of which from residues		24.7	24.0	22.9	27.7	23.7	22.9	39.1	35.9	31.5	19.9
Imports of slab	+	30.5	26.3	25.4	24.8	29.0	50.8	58.1	75.9	62.2	61.9
Exports of slab	–	10.1	20.2	20.3	16.4	29.3	47.6	37.1	25.1	15.0	32.1
Increase in stock	–	3.6	11.3	19.6	11.9	22.0	0.6	–	21.4	5.8	–
Decrease in stock	+	–	–	–	–	–	–	11.6	–	–	1.8
Slab consumption		202.5	202.3	239.0	220.2	225.4	264.1	290.4	306.1	222.5	265.1
Net imports of zinc alloys		1.4	4.2	5.5	5.1	9.8	9.8	5.4	1.9	9.3	18.2
Direct use of scrap		98.3	93.5	68.7	76.5	72.5	63.9	90.2	64.0	75.0	74.0
Total consumption		302.2	300.0	313.2	301.8	307.7	337.8	386.0	372.0	306.8	357.3
Secondary production as % of total consumption		40.7	39.2	29.2	34.5	31.3	25.7	33.5	26.9	34.7	26.3

ZINC: SCRAP ARISING FROM DOMESTIC SOURCE IN FRANCE : TABLE 21.2.17 d

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	123.0	117.5	91.6	104.2	96.2	86.8	129.3	99.9	106.5	93.9
Δ (E-I) Brass ingots	+ 0.5	-	-	+ 0.1	+ 0.1	- 0.1	- 0.4	- 1.0	- 0.3	
Δ (E-I) Ashes and residues	- 1.5	- 1.9	- 3.3	- 5.0	- 4.8	- 4.3	-50.0	-10.0	-10.0	
Δ (E-I) Zinc scrap	-12.9	-16.8	-16.2	-15.8	-18.8	-16.2	-20.5	-22.6	-10.4	
Δ (E-I) Brass scrap	+ 1.1	-	+ 0.6	+ 1.1	+ 0.9	+ 1.3	+ 2.9	+ 3.1	+ 2.4	
Domestic arising scrap	110.2	98.8	72.7	84.6	73.6	67.5	61.3	69.4	88.2	
Domestic arising scrap as % of total consumption	36.5	32.9	23.2	28.0	23.9	20.0	15.9	18.7	28.7	

ZINC BALANCE SHEET 1967-1976 IN GERMANY F.R. : TABLE 21.2.16 e

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		142.8	147.3	157.3	160.8	164.9	151.7	151.9	144.5	144.4	143.0
Import of ore	+	78.7	115.3	171.3	177.7	173.5	245.0	304.1	312.6	269.1	281.2
Export of ore	-	47.5	57.1	29.5	24.4	27.0	21.5	40.2	37.2	31.3	30.9
Apparent consumption		174.0	205.5	299.1	314.1	311.4	375.2	415.8	419.9	382.2	393.3
Slab production		182.3	203.3	277.5	301.2	262.6	358.7	395.0	400.0	294.7	304.8
of which from residues		45.7	51.0	59.3	67.0	55.7	67.3	64.5	66.6	65.0	65.0
Import of slab	+	136.1	182.2	175.1	148.1	164.3	133.5	106.6	89.1	82.3	116.9
Export of slab	-	17.9	27.4	30.6	47.5	38.6	91.2	91.6	64.6	66.5	92.2
Increase in stock	-	-	-	23.6	6.1	0.7	-	-	35.4	13.1	-
Decrease in stock	+	2.2	3.4	-	-	-	12.0	28.2	-	-	1.7
Slab consumption		302.7	361.5	398.4	395.7	387.6	413.0	438.2	389.1	297.4	331.2
Δ (I-E) Zinc alloys		+ 1.3	+ 2.2	+ 2.5	+ 4.2	- 0.5	- 0.5	- 4.1	- 4.6	- 3.6	-
Direct use of scrap		79.6	66.0	72.2	51.8	67.9	53.4	70.2	60.2	65.1	97.3
Total consumption		383.6	429.7	473.1	451.7	454.9	465.9	504.3	444.7	358.9	428.5
Secondary production as % of total consumption		34.2	28.5	28.3	26.9	27.7	26.3	27.6	30.4	36.1	37.2

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN GERMANY F.R. : TABLE 21.2.17 e

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Δ (E-I) and stock variation of remelted zinc	+ 5.7	+ 5.5	+ 2.2	+ 2.8	+ 2.3	+ 1.7	+ 4.5	+ 8.2	- 0.6	- 2.9
Secondary production	131.0	122.5	133.7	121.6	125.9	122.4	139.2	135.0	129.5	159.4
Δ (E-I) Brass ingots	- 4.2	- 5.3	- 5.6	- 5.1	- 4.2	- 4.8	- 4.4	- 2.3	- 3.3	- 3.6
Δ (E-I) Ashes and residues	n.a.	n.a.	n.a.	+10.4	+37.3	+41.6	+22.1	- 1.2	-24.8	-41.2
Δ (E-I) Zinc scrap	+ 4.1	+ 4.9	+ 4.7	+ 3.4	+ 2.6	+ 4.5	+ 6.0	+ 7.0	+ 1.5	- 1.1
Δ (E-I) Brass scrap	- 3.2	- 6.9	- 9.7	- 8.1	- 2.0	- 2.3	- 9.5	- 8.7	- 5.9	- 9.3
Domestic arising scrap	127.7	115.2	123.1	122.2	159.6	161.4	153.4	129.8	97.0	104.2
Domestic arising scrap as % of total consumption	33.3	26.8	26.0	27.1	35.1	34.6	30.4	29.2	27.0	24.3

ZINC BALANCE SHEET 1967-1976 IN IRELAND : TABLE 21.2.16 f

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		30.0	53.3	97.4	96.5	87.5	94.9	68.8	66.3	66.6	62.8
Import of ore	+	-	-	-	-	-	-	-	-	-	-
Export of ore	-	25.0	50.0	100.0	100.0	75.0	85.0	80.0	70.0	78.0	60.0
Slab production		-	-	-	-	-	-	-	-	-	-
Imports of slab	+										
Exports of slab	-										
Slab consumption		1.0	1.0	5.0	5.0	3.1	3.9	4.5	2.3	2.4	2.8

ZINC BALANCE SHEET 1967-1976 IN ITALY : TABLE 21.2.16 g

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		124.6	140.0	132.3	110.7	105.9	102.6	78.6	77.7	78.8	88.5
Import of ore	+	11.2	13.7	31.6	54.4	56.3	78.4	119.2	157.9	101.8	126.5
Export of ore	-	11.7	25.9	21.8	6.5	3.8	-	-	-	5.7	10.6
Apparent consumption		124.1	127.8	142.1	158.6	158.4	181.0	197.8	235.6	174.9	204.4
Slab production (1)		89.0	112.3	130.3	142.1	138.9	155.9	182.0	196.4	179.7	191.2
Imports of slab	+	57.9	37.8	39.0	51.3	33.0	37.6	48.5	43.0	39.2	44.3
Exports of slab	-	-	0.9	0.8	1.9	0.1	0.1	5.0	20.7	28.7	34.9
Increase in stock	-	5.9	-	1.5	13.5	1.8	-	5.5	16.7	40.2	-
Decrease in stock	+	-	5.8	-	-	-	9.8	-	-	-	3.4
Slab consumption		141.0	155.0	167.0	178.0	170.0	203.0	220.0	202.0	150.0	204.0
Net imports of zinc alloys		7.8	4.3	6.5	11.7	6.9	9.3	12.4	7.2	6.1	5.2
Direct use of scrap		46.2	48.7	54.5	59.3	71.1	62.7	70.6	80.8	88.9	97.8
Total consumption		195.0	208.0	228.0	249.0	248.0	275.0	303.0	290.0	245.0	307.0
Secondary production as % of total consumption		23.7	23.4	23.9	23.8	28.7	22.8	23.3	27.9	36.3	31.9

(1) Including some production from residues

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN ITALY : TABLE 21.2.17 g

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	46.2	48.7	54.5	59.3	71.1	62.7	70.6	80.8	88.9	97.8
Δ (E-I) Brass ingots	- 6.6	- 5.9	- 6.3	- 7.5	- 6.5	- 6.5	- 4.7	- 7.5	- 2.4	- 3.7
Δ (E-I) Ashes and residues	+ 2.7	- 2.1	- 7.2	- 4.1	- 6.8	- 3.4	+ 1.9	+ 5.2	+ 5.8	+14.4
Δ (E-I) Zinc scrap	- 8.0	- 6.9	- 6.0	- 3.8	- 3.5	- 4.2	- 4.6	- 4.3	- 2.3	-
Δ (E-I) Brass scrap	- 7.4	- 8.6	-10.3	-10.7	- 9.5	- 9.9	-12.0	-14.0	-12.5	-13.9
Domestic arising scrap	26.9	25.2	24.7	33.2	44.8	38.7	51.2	60.2	77.5	94.6
Domestic arising scrap as % of total consumption	13.8	12.1	10.8	13.3	18.1	14.1	16.9	20.8	31.6	30.8

ZINC BALANCE SHEET 1967-1976 IN THE NETHERLANDS : TABLE 21.2.16 h

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		-	-	-	-	-	-	-	-	-	-
Imports of ore	+	45.4	52.9	56.2	49.7	53.8	43.8	59.1	113.8	166.0	154.0
Exports of ore	-	3.9	10.2	11.4	8.1	6.7	5.6	11.9	29.0	14.4	34.0
Apparent consumption		41.5	42.7	44.8	41.6	47.1	38.2	47.2	84.8	151.6	120.0
Slab production		38.7	43.1	46.6	46.2	41.4	47.9	30.5	78.2	116.0	123.2
Imports of slab	+	14.4	16.6	16.4	14.2	21.3	19.2	31.0	42.1	25.1	26.4
Exports of slab	-	24.9	21.7	25.7	23.2	28.4	43.7	34.7	60.7	82.9	122.3
Increase in stock	-	-	-	3.0	-	-	-	-	26.9	29.6	-
Decrease in stock	+	2.1	0.4	-	-	2.3	13.8	5.5	-	-	7.0
Slab consumption		30.3	38.4	34.3	37.2	36.6	37.2	32.3	32.7	28.6	34.3
Δ (I-E) Zinc alloys		+ 1.5	+ 1.7	+ 1.3	+ 1.5	+ 1.2	+ 0.8	+ 0.2	+ 0.6	- 1.6	- 1.0
Direct use of scrap		6.2	7.9	7.4	13.3	12.2	6.0	13.5	9.7	8.0	9.7
Total consumption		38.0	48.0	43.0	52.0	50.0	44.0	46.0	43.0	35.0	43.0

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN THE NETHERLANDS : TABLE 21.2.17 h

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Δ (E-I) Remelted zinc	+ 2.3	+ 2.9	+ 4.1	+ 2.8	+ 2.0	+ 2.4	+ 4.0	+ 5.7	+ 4.2	+ 4.0
Secondary production	8.5	10.8	11.5	16.1	14.2	8.4	17.5	15.4	12.2	13.7
Δ (E-I) Brass ingots	+ 0.7	+ 0.9	+ 1.2	+ 1.0	+ 0.6	+ 0.4	+ 1.2	+ 1.3	+ 0.9	
Δ (E-I) Ashes and residues	-19.5	-21.7	-27.6	-27.4	-56.0	-39.5	-56.5	-27.1	-27.0	
Δ (E-I) Zinc scrap	+ 7.8	+ 8.0	+ 5.8	+ 4.4	+ 8.0	+ 3.7	+ 4.0	+ 4.2	+ 3.4	
Δ (E-I) Brass scrap	+ 3.3	+ 3.2	+ 3.3	+ 3.0	+ 2.9	+ 3.7	+ 4.9	+ 3.8	+ 1.2	

N.B. Statistical data do not allow a correct calculation of the total of secondary production and domestic arising scrap

ZINC BALANCE SHEET 1967-1976 IN THE UNITED KINGDOM : TABLE 21.2.16 i

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Mine production		-	-	-	-	-	1.2	2.9	2.8	2.8	3.3
Imports of ore	+	119.3	166.7	164.9	154.3	136.0	59.3	62.3	109.8	45.1	57.8
Exports of ore	-	-	-	-	0.2	-	3.1	3.6	7.4	13.3	11.1
Apparent consumption		119.3	166.7	164.9	154.1	136.0	57.4	61.6	105.2	34.6	50.0
Slab production		104.3	142.9	151.0	146.6	116.5	73.8	83.8	84.4	53.4	41.6
Imports of slab	+	162.2	171.5	162.2	160.8	171.7	224.7	219.7	195.5	192.2	193.9
Exports of slab	-	10.7	22.0	13.8	11.9	7.8	13.3	20.1	7.9	13.4	7.3
Increase in stock	-	-	11.7	10.5	17.7	6.7	5.9	-	3.5	25.1	-
Decrease in stock	+	2.7	-	-	-	-	-	22.0	-	-	12.2
Slab consumption		258.5	280.7	288.9	277.8	273.7	279.3	305.4	268.5	207.1	240.4
Δ (I-E) Zinc alloys		+ 0.8	+ 0.2	- 0.6	- 1.2	- 1.3	+ 3.5	+ 0.4	+ 4.2	+ 0.5	+ 2.1
Direct use of scrap		80.2	88.5	94.0	93.7	85.6	82.5	89.1	80.4	68.7	65.8
Total consumption		339.5	369.4	382.3	370.3	358.0	365.3	394.9	353.1	276.3	308.3
Secondary production as % of total consumption		23.6	24.0	24.6	25.3	23.9	22.6	22.6	22.8	24.9	21.3

ZINC: SCRAP ARISING FROM DOMESTIC SOURCES IN THE UNITED KINGDOM : TABLE 21.2.17. i

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Secondary production	80.2	88.5	94.0	93.7	85.6	82.5	89.1	80.4	68.7	65.8
Δ (E-I) Brass ingots	+17.3	+14.6	+13.9	+13.4	+11.5	+13.5	+12.6	+10.0	+ 8.7	+ 7.9
Δ (E-I) Ashes and residues	n.a.	n.a.	n.a.	n.a.	+ 4.2	- 1.2	+ 2.1	+16.6	+ 3.1	
Δ (E-I) Zinc scrap	- 4.4	- 2.3	- 0.6	+ 0.3	+ 0.5	- 2.3	- 0.5	+ 1.5	+ 0.9	
Δ (E-I) Brass scrap	+ 0.4	- 1.0	- 0.3	- 1.9	- 0.6	- 0.8	- 3.0	- 0.3	+ 3.1	
Domestic arising scrap	93.5	99.8	107.0	105.5	101.2	91.7	100.3	108.2	84.5	
Domestic arising scrap as % of total consumption	27.5	27.0	28.0	28.5	28.3	25.1	25.4	30.6	30.6	

21.26 - Secondary zinc flow in industry

The most important source of secondary materials is the galvanizing industry. The scrap arising from this industry provides a high percentage of the raw material for the production of zinc-based chemicals and zinc dust.

21.26.A - New scrap

- Galvanizing scrap and waste

Hot dip galvanizing is a process whereby a corrosion resistant zinc iron alloy coating is produced on steel by immersion in molten zinc. In service, the zinc coating corrodes preferentially the iron and therefore protects it sacrificially. Over a period of years the zinc coating gradually disappears, and rusting of the steel then takes place. If old galvanized articles are recycled, it is as ferrous scrap and the zinc is only recovered, if at all, as oxide from fumes collected from steel making furnaces. Since molten zinc oxidizes in air and alloys readily with iron, the galvanizing process produces 'ashes', 'skimmings', 'blowings', and 'drosses', from which some remelted zinc is produced by simple screening and melting; the residue is used in chemical manufacture.

'Ashes' are largely the zinc oxidation products which form on the surface of the galvanizing bath. In addition to zinc oxide, the ashes, whose zinc content is usually about 70 %, contain entrapped metallic zinc, iron, lead and chloride fluxes. The term 'skimmings' is usually applied to old spent flux which is removed from the surface of the molten zinc.

'Blowings' arise from the galvanizing of tubes. 'Dross' consists of a zinc/iron alloy formed by the reaction of molten zinc with the work piece being treated and the steel or iron bath containing the zinc.

On table 21.2.18, the percentage of new scrap arising from galvanizing is indicated.

TABLE 21.2.18

% SCRAP ARISING FROM GALVANIZING

Galvanized work	Production of		
	Ashes, blowings, and skimmings	Drosses	Total new scrap
General	18	17	35
Sheet and strip	6	4	10
Wire	10	11	21
Tube	30	13	43

Source : Lead and Zinc Development Association.

A potential source of secondary zinc are the galvanized sheet chippings (clippings) which are at present recycled as relatively cheap steel scrap and are not accounted as zinc new scrap. Galvanized chippings are calculated at 20 % of galvanized sheet and strip zinc consumption. At present, as they are not recycled, they are not included in new scrap.

- Diecasting scrap

New scrap generation is calculated at 4 % of zinc alloy used. As the manufacture of diecastings requires alloys of very high purity - 99.995 % zinc is employed - the use of scrap arisings from outside the diecasting plant, and the use of secondary or remelt is restricted by the suppliers of proprietary ingot.

- Rolled zinc scrap

Scrap arises during the fabrication of sheet due to cuttings and chippings but this material is partially recovered 'in house'. It is estimated that about 10 % of slab zinc used is new scrap.

- Brass

This alloy of copper, which normally contains between 30 % and 40 % zinc, is a major source of secondary material, though conventionally it is recycled through the copper industry rather than the zinc one.

The scrap brass is used to make new articles, closely allied to the original composition, with virgin zinc only added to make up final tonnages in conjunction with addition of secondary refined copper. New scrap generated is calculated from the C.E.C.-DG XII "Copper Dossier".

- Ashes and residues

During the processing of brass scrap and melting of zinc, some zinc is volatilized off and collected in a bag-house - this fume can be used for the production of zinc chemicals or slab zinc.
It is calculated at 5 % of recycled metallic zinc.

21.26.B - Old scrap

The availability of old scrap is important for recycling purposes and its potential for supplying future demand.
According to Section 21.25, zinc scrap recycling is restricted to the following zinc products : brass mill products, zinc alloys and rolled zinc products.

- Brass scrap

Recycling concerns obsolete products from the following sectors of utilization : Building, Transport, General Engineering, Domestic Goods, and Miscellaneous. For the present period we assume a recycling rate of 25 %, according to the indications given in the Dossier on Copper.

- Diecasting scrap

Zinc base diecastings are used for engineering and decorative purposes in a wide variety of industries, the largest being car manufacture, domestic appliances, and toys.

Pattern of consumption by final users in the U.K., the U.S.A. and Italy is illustrated on table 21.2.19.

TABLE 21.2.19

% OF DIECASTING CONSUMPTION BY FINAL USERS

Users	UK	USA	Italy
Automotive components	34	51	31
Builder's hardware	18	19	20
Electrical components	4	7	2
Domestic appliances	7	8	6
Industrial, agricultural and commercial machinery	7	8	3
Cutlery, ornamental goods and miscellaneous	5	2	24
Sporting goods and toys	16	3	14
Scientific and professional equipment	3	1	-
Sound and TV	6	1	-
	100	100	100

Possibilities for recycling exist in the automotive components, builder's hardware, and industrial-agriculture machinery sectors.
The other components should be disposed of in urban refuse.
In the U.S.A., for the above sectors, we have a recycling rate of 20 %, 5 %, 70 % respectively.
No data are available for the European countries, but in our opinion the recovery in the automotive components sector is higher because of larger density of population.

- Rolled zinc scrap

  There are three major applications for rolled zinc. The production of battery cans, sheet for architectural purposes and sheet for printing and address plates.
  In the lithographic and photoengraving sector the recycling rate is high (70 % in the U.S.A.), very low in the roofing sector, and nil in the battery cans sector.

Secondary zinc flow in industry may be summarized as follows : the major user of zinc scrap is the chemical industry which produces four main products : zinc dust, zinc oxide, sulphate, and chloride.
Galvanizing scrap and waste represent the basic raw material for chemical industry.
Non-metallic residues - ashes from hot dip galvanizing and from brass melting - are utilized for chemical products.
Metallic residues - mainly dross from hot dip galvanizing and metallic portions from ashes and from die casting and rolled zinc - constitute the basic feed for zinc dust production.
Dross is also utilized for zinc oxide - lower grade - production.
The amount of scrap residues is insufficient to cope with the demand of converters.

Brass scrap, whether new or old scrap, is used to make new articles, closely allied to the original composition, with virgin zinc only added to make up final tonnages in conjunction with additions of secondary refined copper. Old brass scrap constitutes the major part of zinc old scrap.

Old rolled zinc scrap is remelted and used as metallic residues mainly for zinc dust production.

21.27 - Scrap availability in EEC countries and future availability (zinc)

Though incomplete, the statistical data and the data which can be drawn from the surveys conducted in the countries of the Community allow to assess the amount of zinc domestic scrap at 450 000 tons in the period 1970-1974. This figure may be in default as some new scrap is included in the circulating scrap or, in some countries, it is used, without being declared, as feed in the primary metallurgy. The possible composition of total available scrap has been re-built applying the coefficients of new scrap generation indicated in Section 21.26, and the recycling rate for brass old scrap.
The following considerations have been developed to calculate the scrap availability in 1985 and 1990.

21.27.A - New scrap

- Zinc sheet chippings (clippings)

Fabrication of galvanized sheet and strip gives trimmings that are scrapped. These are recycled as steel scrap with the zinc still on it. This zinc is lost out of the stack.
Galvanized clippings contain 4 % to 5 % zinc and 95 % or 96 % iron. An economic method for separating the zinc from the steel would increase the value and it would reduce corrosion of steel furnace refractories and make air pollution control easier.
Zinc in clippings recyclable in 1971-1974 : 40 000 t.p.y. ;
recyclable in 1985-1990 : 60 000-65 000 t.p.y.
R & D should be undertaken to develop an economical process for the direct recovery of zinc from galvanized clippings as an alternative to recycling as steel scrap with the zinc on it.

21.27.B - Old scrap

- Zinc base alloys

Nearly all zinc base alloy scrap is in the form of die castings. The die castings vary in size from fractional grams to a few Kgs.
The die castings often contain inserts of steel, brass or other materials in autos, home appliances, machinery, etc ...

Inserts of other metals can be easily removed. The difficulties involve economical separation of the die castings from the larger products of which the die castings are part; larger, easily-accessible die castings can be removed by hand and smaller, inaccessible die castings can be removed by desintegration and separation equipment such as auto shredders.
Separation from ferrous metals is easily accomplished magnetically; separation from non-ferrous metals may be accomplished by cryogenic and chemical methods.

R & D should be undertaken to develop economical methods and equipment for the mechanized separation of zinc, aluminium, copper and non-magnetic stainless steel.
R & D work has proved feasible a 97 % recovery zinc separation from non-magnetic fractions in auto shredders.

Excellent separation of zinc die casting alloy from copper and aluminium in shredder automobile non-ferrous metal concentrates is obtainable by the use of cryogens. From the screened products, 97.2 % and 100 % of the copper and aluminium, respectively, were recovered and 100 % of the zinc was recovered at over 97 % zinc die casting purity.

On the basis of the assumptions considered for copper industry, a recycling rate of 20 % could be anticipated for die casting in builder's hardware; an overall recycling rate for the remaining fractions disposed of in urban refuse of 20 %, in the hypothesis that 40 % of the total domestic solid waste are treated with a zinc recovery of 50 %.
The average recycling rate for die casting (see pattern of consumption, Section 21.26)is estimated at 37.5 %.

- Rolled zinc scrap

Lithographic and photoengraving = recycling rate 70 %
Roofing = recycling rate 40 %
Dry batteries = No zinc is currently being recovered from dry cells and a 20 % recovery could be achieved by the treatment of household refuse.

In the U.S.A. recent concern relating to water pollution possibilities because of mercury contained in dry cells batteries has resulted in a proposal that these batteries, like soft drinks bottles, require a deposit at the time of purchase that can be recovered only if the spent cells are returned when they are replaced with new ones.
The following breakdown by main uses has been assumed :

	%
Roofing	67.5
Dry batteries	10.0
Lithographic and photoengraving	10.0
Coffins	7.5
Address plates, various	5.0
	100.0

- Brass products

This category includes brass mill products and all brass foundry products which are employed mainly in General Engineering in copper pattern of consumption. Because of diversification and fragmentation of applications, difficult problems exist in metal segregation, which efficiency is estimated of the order of 60 %. An investigation should be undertaken to determine the reasons for such a low segregation efficiency and to suggest improvements in processing.

- Old galvanizing

Some zinc is potentially recoverable from old galvanized products if consideration is given to the zinc contained in steel mill flue dust. Much of the zinc contained in stack emissions is ultimately derived from galvanized materials contained in the scrap consumed by steel mills.
Utilizing the following parameters from Bureau of Mines 'Recovery of secondary copper and zinc in the U.S.A.' report :

	lb of dust per ton of steel	% Zn in the dust
Open hearth furnace	25	5
Basic oxygen process	20	3
Electric furnace	20	16

it is possible to assess at 80 000 tons the zinc content in fumes for the EEC. This amount is considered recyclable as technology for zinc recovery from iron and steel works has already been finalized : Krupp waste recovery process; Lurgi process in operation at Berzelius Metallhütten GmbH in West Germany; plant in operation in Japan, Sotetsu Metal Company. Projects are in advanced stages of realization in France and, possibly, in the U.K. in connection with existing I.S. Furnaces.

- Flue dusts

Large quantities of flue dusts at high concentration of zinc are generated at steel mills, zinc smelters, remelters, galvanizers, incinerators.
Besides flue dusts at steel mills, flue dusts have been considered from zinc and brass remelters (see Section 21.26).

- Oxides and chemicals

Close to half of the zinc oxides and chemicals are scrapped as constituents of rubber products. It is not economic to recycle the zinc in constituents of paints, papers, textiles, and chemicals. Economic recovery of zinc oxides and chemicals from scrap rubber products might be possible if economic recycling of rubber is accomplished; another possibility is recovery of zinc as flue dust if scrapped rubber can be burned as fuel.
R & D should be undertaken to develop such a process

Future scrap availability (tables 21.2.20 - 21.2.21)

To calculate the new scrap, consumption figures anticipated for galvanizing in Section 24.5 have been broken down as follows :

	1985		1990	
	'000 tons	%	'000 tons	%
General	285	33	326	35
Sheet	356	44	386	41
Wire	101	12	115	12
Tube	98	11	113	12
	840	100	940	100

OLD SCRAP : TABLE 21.2.20

Source	Life cycle years	Years of zinc consumption used to calculate zinc availability by 1985	1990
Zinc base alloys			
Construction equipment	15		
Automotive	10		
Builder's hardware	25		
Domestic appliances	12		
Cutlery and ornamental	12		
Toys	7		
Average	13	1972	1977
Old galvanized	20	1965	1970
Oxides and chemicals	2	1983	1988
Brass	16	1969	1974
Dry batteries	1	1984	1989
Roofing and construction	25	1960	1965
Lithographic	1	1984	1989

SCRAP AVAILABILITY : TABLE 21.2.21
(tons of zinc recycled)

Source	1970-1974 average	1985	1990
NEW SCRAP			
Galvanizing work			
Drosses	62,000	87,000	99,000
Ashes,blowings,skimmings	78,000	113,000	130,000
Galvanized clippings	-	50,000	60,000
Die casting	10,000	15,000	18,000
Rolled zinc	20,000	18,000	16,000
Brass	105,000	155,000	182,000
Ashes and residues	15,000	27,000	30,000
Subtotal	290,000	465,000	535,000
OLD SCRAP			
Old galvanized	-	40,000	40,000
Brass	40,000	85,000	90,000
Rolled zinc	120,000	70,000	70,000
Die casting		100,000	95,000
Subtotal	160,000	295,000	295,000
GRAND TOTAL	450,000	760,000	830,000

21.28 - Conclusions

A - The recycling rate of obsolete products in non-ferrous metals - Cu, Pb, Zn - is considerably lower than the rate deemed theoretically achievable. Objective difficulties do exist in recycling of certain obsolete products; nevertheless the collection of obsolete products is oriented towards those obsolete products considered of an economic value within the present structure of the recycling industry and applied technologies.

To improve the recycling rate, it is necessary to promote a global action concerted by government bodies who are responsible for environment protection policies, by associations of economic operators in the field of recovery and recycling , by experts in the recycling industry.

In our opinion, the means for achieving a recycling rate of old scrap in the medium long term are illustrated below :

. To improve the present methods of collecting statistical data by introducing direct data collections on new scrap and finished products destined to exports, so as to have more information available for carrying out more accurate assessments on the quantity of finished products entering the market and of the old recycled scrap.

. To ameliorate the image of the recycling industry by establishing certain rules and to intensify the process, already being carried out, of concentrating the companies at a large-merchant level in order to increase their financial capacity and specialization degree, acquiring at the same time an industrial size.
This would result in increased opportunities for recycling and improved dealing capacities,with the aim to set for the recycled materials the same prices as quoted for primary materials of equal quality.

. To revise specifications and standards on scrap materials so that the recycled materials are not considered unfavourably in comparison with the primary materials.

. To introduce economic incentives for the realization of recycling plants for materials considered as marginal and submarginal, to introduce methods of depletion allowances on recycling, and to modify tax structure accordingly.

. To study the possibility of applying differentiated tariffs for the transport of recycling materials.

. To work out a research and development programme to create texts for consultation to be made available to the recycling industry concerning, 1) technological problems, 2) purchasing, installing, using and maintaining processing plants, 3) rationalization of processes for manufacturing products so that the finished products are more easily recyclable. Such an R & D programme would promote differentiation in solid waste.

B - Specific problems connected to lead scrap recycling, presenting an economic interest and susceptible of improvement through a stricter control and development of suitable techniques, are those concerning the collection of lead sheathed power and telecommunication cables for the recovery of lead and copper, the present recycling rate of which is lower than 50 %, as well as those concerning other obsolete products : pipes, fittings, sheet, terne metal, lead plating.
No R & D actions are to be considered for lead recovery from obsolete products.

C - Specific problems concerning zinc scrap recycling consist in the necessity of :

- intensifying collection through a different technical and economical approach in the building - construction sector of utilization - plumbers fitting and brassware and builders hardware;

- optimizing collection in the general engineering sector of utilization which absorbs 44 % of total copper alloys, semi-finished and castings consumption;

- rationalizing collection and utilization of automobile shredder units;

- developing installations for zinc (and lead) recovery from steel mill stack dust : zinc recyclable from flue dust in iron and steel mills in the EEC is estimated to be 80 000-90 000 tons;

- developing a comprehensive analysis of solid waste problem - of municipal and industrial, commercial and household origin - which should take into consideration also the recovery of non-ferrous metals : Al, Cu, Zn, and Pb.

Recommendations for R & D have already been developed in Section 21.27.

21.3 - METAL PRODUCERS (tables 21.3.1 to 21.3.7)

Production of refined lead in the Western world moved from 2.3 Mt in 1963 to 3.0 Mt in 1972 (+3.2 % average per annum). In the following period, after registering 3.1 Mt in 1973-1974, it fell down in 1975 but showed a partial recovery in 1976 going back to approx. 1972 levels.

The Eastern world, with a 4.9 % growth rate until 1972 and 1.0 % during the following years, moved from 0.7 Mt in 1963 to 1.1 Mt in 1976.

In the Western world the share held by secondary refined of refined lead overall production was about 20 % in the last decade.

In respect to this average situation, in the major economic areas the incidence of secondary refined was as follows :

EEC	about 40 %
USA	18 %-22 % with some remarkable variations
Japan	15 %-20 % with a peak in 1976.

Referring to overall production of refined lead, as regards the major countries or economic producer areas of the Western world, the EEC maintained its position represented by 30 % of the total, with a production of about 250 000 tons.
The U.S.A., on the contrary, moved up to 26 % in 1976 from 21 % in 1963. Japan and Australia, though registering both of them approx. 7 % in 1976, showed, in terms of percent, a completely different trend : the former accounted for only 4.4 % of the Western world in 1963, while the latter accounted for 11 %.

As far as slab zinc production in the Western world is concerned, this moved from 2.7 Mt in 1963 to 4.1 Mt in 1972, with an average growth rate of 4.6 % per annum. Over the following period, a rise was registered in 1973-1974 (4.35 Mt in 1974) and, after the fall occurring in 1975 (approx. -14 %), partial recovery was achieved by going back again to 1972 levels.

The Eastern world, with +6.3 % growth rate until 1972 and -4.3 % in the following years, passed from 0.8 Mt in 1963 to 1.7 Mt in 1976.

As regards the evolution of the primary metallurgical industry of zinc in the Community, during the 60's and 70's, the metallurgical industry underwent major modifications as to characteristics and capacity of the plants, as shown in table 21.3.7.
One of the first modifications consisted of the application of the Imperial Smelting process which was to replace the retort thermic plants. Up to the end of 1972, four IS plants were installed, with a total nominal capacity of 280 000 tons, one of them in substitution of an obsolete plant. At present, considering all modifications and improvements carried out, the nominal capacity is 370 000 tons.

The thermic metallurgical plants (electrothermic, horizontal and vertical retorts) are fitted, with just one exception, with distillation columns for the production of 99.99/99.995 zinc.
Electrolytic zinc production capacity moved from 271 000 tons to 1 138 000 tons and accounts for 64 % of the overall capacity. This increase was obtained by the enlargement of existing facilities and the construction of new production units.
The utilization rate of the plants in the Community was 64 % in 1976. Despite this unfavourable index, the EEC accounted for 27.7 % of the Western world's production (along the line of the incidence registered in the past years) with a production of about 1 150 Mt.
By contrast, the U.S.A. passed from 31.5 % in 1963 and 16 % in 1972 to 12 % in 1976, while Japan's incidence was 11 %, 20 % and 18 %, respectively.

REFINED LEAD PRODUCTION : TABLE 21.3.1.

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.		101.2	100.1	102.4	94.3	84.1	97.4	103.0	99.6	106.4	105.7
Denmark		9.9	9.7	12.0	16.0	11.4	12.0	13.4	14.9	13.7	18.0
France		144.7	148.2	155.8	170.0	158.5	186.9	186.4	177.4	150.7	172.4
Germany F.R.		288.9	273.4	305.3	305.4	302.0	273.4	302.6	321.4	260.2	278.3
Italy		72.3	76.2	80.0	79.3	75.9	69.2	46.6	65.2	43.9	64.2
Netherlands		14.9	17.5	14.8	17.9	23.6	22.0	25.3	26.4	23.9	21.9
United Kingdom		191.7	235.6	260.5	287.0	263.6	270.6	265.1	279.6	241.3	251.5
	E E C	822.9	860.7	930.8	969.9	919.1	931.5	942.4	981.8	840.1	912.0
Other Europe		229.7	239.8	267.2	251.5	255.3	255.5	268.5	268.7	275.7	259.5
	EUROPE	1,052.6	1,100.5	1,198.0	1,221.4	1,174.4	1,187.0	1,210.9	1,250.5	1,115.8	1,171.5
South West Africa		69.4	55.4	69.5	67.9	69.8	64.7	66.7	64.2	44.3	39.6
Other Africa		54.9	59.2	66.0	74.9	66.1	56.2	51.9	52.2	50.6	65.0
	AFRICA	124.3	114.6	135.5	142.8	135.9	120.9	118.6	116.4	94.9	104.6
Japan		150.0	164.6	186.6	209.0	215.1	223.2	228.0	228.0	194.2	219.1
Other Asia		18.7	19.4	17.2	16.4	16.7	16.7	23.0	19.4	16.3	20.0
	ASIA	168.7	184.0	203.8	225.4	231.8	239.9	251.0	247.4	210.5	239.1
Brazil		17.3	16.4	18.7	19.5	25.7	25.0	34.8	41.7	37.5	43.7
Canada		175.3	183.3	169.8	185.6	168.3	186.9	187.0	126.4	171.5	175.7
Mexico		160.3	172.1	169.5	174.7	154.7	161.3	188.9	182.7	154.3	172.7
Peru		81.8	86.4	77.5	72.0	68.0	85.6	82.9	80.2	71.0	74.1
USA		475.5	554.9	720.9	748.3	715.9	760.9	759.3	791.0	771.0	764.5
Other America		35.8	37.8	41.0	38.1	43.5	39.5	37.8	37.2	36.1	40.0
	AMERICA	946.0	1,050.9	1,197.4	1,238.2	1,176.1	1,259.2	1,290.7	1,259.2	1,241.4	1,270.7
	OCEANIA	217.8	202.8	221.2	212.9	193.4	208.9	220.9	224.8	193.5	213.0
	WESTERN WORLD	2,509.4	2,652.8	2,955.9	3,040.7	2,911.6	3,015.9	3,092.1	3,098.3	2,856.1	2,998.9
	EASTERN WORLD	842.9	877.2	927.2	945.7	1,007.0	1,058.5	1,105.1	1,155.5	1,169.1	1,101.1
	TOTAL	3,352.3	3,530.0	3,883.1	3,986.4	3,918.6	4,074.4	4,197.2	4,253.8	4,025.2	4,100.0

GROWTH IN REFINED LEAD PRODUCTION : TABLE 21.3.2.
(percentage per annum)

		1972/1963	1976/1972
Belgium-Lux.		- 0.1	+ 2.1
Denmark		+ 4.8	+ 10.7
France		+ 6.5	- 2.0
Germany F.R.		+ 2.0	+ 0.4
Italy		+ 4.2	- 1.9
Netherlands		+ 7.9	- 0.1
United Kingdom		+ 5.9	- 1.8
	E E C	+ 3.9	- 0.5
Other Europe		+ 0.3	+ 0.4
	EUROPE	+ 3.0	- 0.3
South West Africa		(1)	- 11.6
Other Africa		+ 1.0	+ 3.7
	AFRICA	+ 9.6	- 3.6
Japan		+ 9.2	- 0.5
Other Asia		- 4.3	+ 4.6
	ASIA	+ 7.4	- 0.1
Brazil		+ 4.7	+ 15.0
Canada		+ 3.2	- 1.5
Mexico		- 1.4	+ 1.7
Peru		+ 0.6	- 3.5
USA		+ 5.4	+ 0.1
Other America		+ 0.9	+ 0.3
	AMERICA	+ 3.4	+ 0.2
	OCEANIA	- 1.9	+ 0.5
	WESTERN WORLD	+ 3.2	- 0.1
	EASTERN WORLD	+ 4.9	+ 1.0
	T O T A L	+ 3.6	+ 0.2

(1) Negligible data

LEAD PLANTS' CAPACITY - '000 TONS : TABLE 21.3.3.

	Smelters	Refineries		
		Primary	Secondary	Total
Belgium-Lux.	(1) 125	(1) 125	10	135
Denmark	-	-	40	40
France	140	140	100	240
Germany F.R.	(1) 240	(1) 315	45	360
Italy	68	36	40	76
Netherlands	-	-	40	40
United Kingdom	40	150	161	311
E E C	613	766	436	1,202
Austria	15	15	-	15
Greece	(1) 30	(1) 30	-	30
Spain	(1) 128	(1) 128	15	143
Sweden	65	55	35	90
Yugoslavia	150	120	-	120
EUROPE	1,001	1,144	486	1,600
Morocco	35	35	-	35
S.W. Africa	82	82	-	82
Tunisia	30	30	-	30
Zambia	28	28	-	28
AFRICA	175	175	-	175
Burma	23	40	20	60
India	18	18	-	18
Japan	(1) 226	(1) 268	-	268
South Korea	10	10	-	10
Turkey	6	6	-	6
ASIA	283	342	20	362
Argentina	39	45	-	45
Brazil	50	50	-	50
Canada	253	253	-	253
Mexico	260	344	-	344
Peru	90	90	-	90
USA	805	708	200	908
AMERICA	1,497	1,490	200	1,690
AUSTRALIA	399	230	25	255
WESTERN WORLD	3,355	3,351	731	4,082

(1) Including some secondary

SLAB ZINC PRODUCTION : TABLE 21.3.4.

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.		223.8	247.3	257.4	232.6	209.1	255.6	277.7	288.8	218.2	236.1
France		185.7	207.5	253.5	223.7	218.7	261.5	257.8	276.7	181.1	233.5
Germany F.R.		182.3	203.3	277.5	301.2	262.6	358.7	395.0	400.0	294.7	304.8
Italy		89.0	112.3	130.3	142.1	138.9	155.9	182.0	196.4	179.7	191.2
Netherlands		38.7	43.1	46.6	46.2	41.4	47.9	30.5	78.2	116.0	123.2
United Kingdom		104.3	142.9	151.0	146.6	116.5	73.8	83.8	84.4	53.4	41.6
	E E C	823.8	956.4	1,116.3	1,092.4	987.2	1,153.4	1,226.8	1,324.5	1,043.1	1,130.4
Other Europe		191.7	229.9	238.6	285.3	285.1	319.6	340.4	390.1	411.9	447.2
	EUROPE	1,015.5	1,186.3	1,354.9	1,377.7	1,272.3	1,473.0	1,567.2	1,714.6	1,455.0	1,577.6
Algeria		-	-	-	-	-	-	-	8.0	20.0	20.0
South Africa		-	-	11.8	26.9	42.4	47.1	53.1	65.4	63.7	66.2
Zaire		61.0	62.6	63.7	63.5	62.7	66.7	67.7	68.7	65.6	60.9
Zambia		45.2	53.5	50.5	53.8	57.0	56.0	53.4	58.3	46.9	38.3
	AFRICA	106.2	116.1	126.0	144.2	162.1	169.8	174.2	200.4	196.2	185.4
India		3.0	19.9	23.1	23.4	21.2	25.2	12.8	21.1	22.7	26.8
Japan		516.2	605.6	717.0	680.7	719.8	809.0	844.0	849.9	698.4	742.1
South Korea		2.5	2.5	2.3	2.8	8.9	10.5	12.6	11.5	20.9	27.2
Turkey		-	-	-	-	-	-	-	-	-	8.0
	ASIA	521.7	628.0	742.4	706.9	749.9	844.7	869.4	882.5	742.0	804.1
Argentina		23.0	20.9	24.6	32.0	32.7	36.5	33.3	37.2	39.5	35.2
Brazil		2.6	2.6	5.0	10.5	16.3	15.6	22.3	30.5	31.4	43.2
Canada		359.4	387.3	423.1	417.9	372.5	476.2	532.6	426.3	426.9	472.3
Mexico		75.7	81.8	85.7	80.7	83.4	83.8	67.2	133.4	149.0	161.3
Peru		61.7	65.8	62.4	68.7	59.1	67.2	67.1	69.0	63.2	64.5
USA		918.4	998.7	1,008.0	866.3	768.7	641.3	604.8	574.9	449.9	486.1
	AMERICA	1,440.8	1,557.1	1,608.8	1,476.1	1,332.7	1,320.6	1,327.3	1,271.3	1,159.9	1,262.6
	OCEANIA	195.0	205.5	252.8	268.4	265.7	303.7	306.4	283.8	200.3	249.6
	WESTERN WORLD	3,279.2	3,693.0	4,084.9	3,973.3	3,782.7	4,111.8	4,244.5	4,352.6	3,753.4	4,079.3
	EASTERN WORLD	1,061.5	1,129.6	1,205.3	1,273.1	1,351.5	1,441.9	1,589.6	1,653.0	1,739.9	1,709.5
	TOTAL	4,340.7	4,822.6	5,290.2	5,246.4	5,134.2	5,553.7	5,834.1	6,005.6	5,493.3	5,788.8

GROWTH IN SLAB ZINC PRODUCTION : TABLE 21.3.5.
(percentage per annum)

		1972-1963	1976-1972
Belgium-Lux.		+ 2.4	- 2.0
France		+ 5.0	- 2.8
Germany F.R.		+ 9.0	- 4.0
Italy		+ 8.7	+ 5.2
Netherlands		+ 3.4	+26.6
United Kingdom		- 3.4	-13.4
	E E C	+ 4.9	- 0.5
Other Europe		+ 7.3	+ 8.8
	EUROPE	+ 5.4	+ 1.7
	AFRICA	+ 5.8	+ 2.2
Japan		+12.0	- 2.1
Other Asia		(1)	+14.8
	ASIA	+12.5	- 1.2
Canada		+ 7.1	- 0.2
Mexico		+ 4.6	+17.8
Peru		+ 2.3	- 1.0
USA		- 3.3	- 6.7
Other America		+11.4	+10.8
	AMERICA	+ 0.6	- 1.1
	OCEANIA	+ 6.1	- 4.8
	WESTERN WORLD	+ 4.6	- 0.2
	EASTERN WORLD	+ 6.3	+ 4.3
	TOTAL	+ 5.0	+ 1.0

(1) Negligible data

TABLE 21.3.6.

ZINC PLANTS' CAPACITY - '000 TONS

Belgium-Lux.		431
France		378
Germany F.R.		462
Italy		255
Netherlands		150
United Kingdom		90
	E E C	1,766
Austria		17
Finland		150
Norway		90
Spain		260
Yugoslavia		125
	EUROPE	2,408
Algeria		40
South Africa		100
Zaire		68
Zambia		67
	AFRICA	275
India		95
Japan		978
South Korea		50
Turkey		40
	ASIA	1,163
Argentina		49
Brazil		47
Canada		655
Mexico		211
Peru		70
USA		628
	AMERICA	1,660
	AUSTRALIA	322
	WESTERN WORLD	5,828

TABLE 21.3.7. : **ZINC SMELTERS' CAPACITY IN THE EEC**

tons

Producers	Location	1965	1970	1977
Ammi	Monteponi	8.000 E	15.000 E	15.000 E
	Marghera	36.000 E	45.000 E	45.000 E
	P. Nossa	24.000 E	35.000 E	35.000 E
Pertusola	Crotone	25.000 E	90.000 E	90.000 E
Ammi Sarda	P. Vesme	-	70.000 T-IS n	70.000 T-IS
ITALY		93.000	255.000	255.000
Vieille Montagne	Flone	30.000 T	38.000 T	53.000 T
		47.000 T	inattivo *	-
" "	Balen-Wezel	77.000 E	135.000 E	178.000 E
Hoboken - Overpelt	Overpelt	40.000 T 48.000 T	100.000 T	35.000 T
		36.000 T	inattivo *	100.000 E n
Prayon	Ehein	55.000 T	62.000 T	65.000 E n
BELGIUM		333.000	335.000	431.000
Vieille Montagne	Viviez	72.000 E	94.000 E	110.000 E
	Creil	10.000 T	10.000 T	8.000 T
Peñarroya	Noyelles-Godault	50.000 T-IS	105.000 T-IS	130.000 T-IS
C.R.A.M.	Auby	70.000 T	96.000 T	30.000 T
				100.000 E n
FRANCE		202.000	305.000	378.000
Budelco	Budel	50.000 T	55.000 T	150.000 E n
NETHERLANDS		50.000	55.000	150.000
Preussag AG	Harlingerode	58.000 T	100.000 T	100.000 T
Stolberger AG	Stolberg	45.000 T	inattivo *	-
Berzelius	Duisburg	50.000 T	84.000 T-IS n	84.000 T-IS
Atenbergs für Bergbau und Zinkhütten Betrieb	Essen	29.000 E	inattivo *	-
Preussag-Weser-Zink	Nordenham	30.000 T	43.000 T	110.000 E n
Duisburger Kupferhütte	Duisburg	20.000 T	inattivo *	18.000 T
Ruhr-Zink	Datteln		130.000 E n	150.000 E
GERMANY		232.000	357.000	462.000
Commonwealth Smelting	Avonmouth	39.000 T	39.000 T	inattivo *
	Swansea	57.000 T-IS	57.000 T-IS	inattivo *
	Avonmouth	32.000 T-IS	32.000 T-IS	inattivo *
			90.000 T-IS n	90.000 T-IS
U.K.		128.000	218.000	90.000
IRELAND		-	-	-
TOTAL		1.038.000	1.525.000	1.765.000

E = Electrolytic; T = Thermic; T-IS = Imperial Smelting Furnace;
n = New plant
* = Idle

21.4 - PRODUCTION COSTS

Production costs vary over a wide range, depending on geographic location, capacity, amount of infra-structure included, date of completion and methods used to report the various cost items.

A particular problem in processing cost estimates is that they depend on the process used, particularly in the case of primary extraction, depending on the mining methods used and on the technology required in the beneficiation of specific types of ore.

A particular problem in estimating production costs is that the lead and zinc occur in association between them and with silver and other by-products.

Because the proportion of lead, zinc and precious metals varies from mine to mine, an appropriate technique was to be adopted to allocate individual unit costs for mining and milling.

As a result, cost estimates very seldom apply to a specific situation.

We think it will be useful to report the essential lines of the conclusions reached in a study conducted by the Stanford Research Institute and published by S.R.I. - Project E.C.C. 3742 - April 1976.

Production costs have been estimated from various sources including the literature (U.S. Bureau of mines report, private reports and from conversations with industry representatives).

Cost data have been adjusted with various escalating factors to update them to 1975 conditions.
Mining and milling costs have been estimated on the basis of ore mined and milled. Smelter and refining costs are estimated on a per metric ton of zinc basis.

Production cost estimates for the United States, Canada and Australia have been developed on the basis of mining, milling and smelting costs in these countries. These estimates are based on certain operation assumptions believed to approximate the conditions of a metal production new facilities. The basic assumptions are listed in table 21.4.1.

TABLE 21.4.1

OPERATING CONDITIONS IN SELECTED COUNTRIES
(Percent)

	United States		Canada		Australia
	Pb Ores	Other Ores	Large Mines	Medium Mines	
Ore grade					
. Zinc	2.56%	3.62%	6.49%	4.33%	9.34%
. Lead	5.92	1.07	2.03	0.03	7.78
. Copper	--	--	0.70	2.04	0.53
. Silver	0.34	0.89	1.77	1.25	4.13
Distribution by mining method					
. Cut and fill	--	8.2	15.7	38.7	74.3
. Room and pillar	90	78.5	9.4	--	--
. Open pit	--	--	61.4	--	--
. Other	10	13.3	13.5	61.3	25.7
Mill recovery					
. Zinc	85.0	87.2	82.7	86.2	86.8
. Lead	88.0	64.3	78.4	49.8	90.9
. Other	85.0	85.0	85.0	85.0	85.0

Source : SRI

In the United States, zinc production has been analyzed for two major sectors : large mining operations based on ores containing primarily lead, and medium to large operations based on zinc and mixed ores. Together these two sectors account for more than 70 % of the zinc mined in the United States.

In Canada, zinc production has been similarly analyzed for large and medium-sized mines which represent over 90 % of Canadian mine production.

Australian zinc production was considered from the stand-point of the six major producers that account for virtually all the zinc production in that country.

The procedure selected for estimating zinc and lead production cost is to allocate individual unit costs for mining and milling in proportion to the smelter revenue expected, after accounting for mine and mill recovery.

The overall cost estimation also includes projections for 1980 and 1985. Such projections recognize the need to attract the necessary capital for new mines, mills and refineries.
In the United States the lead/zinc traditionally has obtained a 10 % return on capital.
It is assumed that investors will expect similar returns in the future. Concurrently, operating costs are expected to increase moderately during the next decade, as they have done in the past.

Higher operating costs are anticipated because of increased energy costs, increasingly stringent pollution control regulations, and higher costs of labor and materials.
The cost projections to the year 1985 assume that labor costs will escalate 2 % annually in real terms, that the cost of materials and supplies about 0.8 % per year and that other costs may increase by 1 % annually in real terms.
In addition depreciable costs are expected to increase by 3 % per year as a result of higher construction wages and higher construction material prices.

TABLE 21.4.2

TOTAL PRODUCTION COSTS FOR LEAD IN THE UNITED STATES
(Constant 1975 Dollars per metric ton of lead)

	1975	1980	1985
	$	$	$
Capital investment (1)	756.2	876.4	1016.3
Depreciable investment (1)	684.0	792.9	916.3
Operating costs:			
Mining	45.2	48.2	51.3
Milling	35.9	37.8	39.8
Smelting and refining	155.1	164.2	173.5
Miscellaneous	26.3	27.6	28.9
Depreciation (2)	45.6	52.9	61.1
Depletion (3)	62.0	94.6	107.8
Interest (4)	8.4	9.7	11.3
Taxes (5)	20.6	42.9	49.9
Net Profits	41.9	87.1	101.4
Total	441	565	625

(1) Allocated to lead production only
(2) Straight-line depreciation over 15 years
(3) At 22% of net smelter revenues
(4) Assumes an 8% interest rate on debt (debt is taken as 13.9% of total capital)
(5) At 33% of taxable income

Source : SRI

TABLE 21.4.3

TOTAL PRODUCTION COSTS FOR ZINC IN THE UNITED STATES
(Constant 1975 Dollars for metric ton of zinc)

	1975	1980	1985
	$	$	$
Capital investment (1)	1311	1518	1762
Depreciable investment (1)	1162	1346	1562
Operating costs :			
Mining	112.8	120.2	128.2
Milling	82.4	86.9	91.8
Electrolytic refining	227.8	259.2	272.0
Miscellaneous	28.5	30.0	31.5
Depreciation (2)	77.5	89.8	104.2
Depletion (3)	134.4	158.8	181.1
Interest (4)	14.6	16.9	19.6
Taxes (5)	60.2	69.4	80.7
Net profits	122.3	140.8	163.9
Total	860.4	972.0	1073.0
Price (cents per pound)	39	44.1	48.7

(1) Allocated to zinc only
(2) Straight-line depreciation over 15 years
(3) At 22% of net smelter revenues
(4) Assumes an 8% interest rate on debt (debt is taken as 13.9% of total capital)
(5) At 33% of taxable income

Source : SRI

Because interest costs assume a constant debt/equity rates, they are also expected to increase at a rate of 3 % annually.

The cost projection on table 21.4.3 indicate that by 1980 the price of zinc should reach 44 cents per pound, and by 1985, it should be close to 49 cents per pound in constant 1975 dollars to provide a 10 % net return on investment, or a cash return of approximately 25 % on total investment.

P A R T 2 . 2

STRUCTURE OF CONSUMPTION

22.1 - LEAD : METAL USERS AND SCRAP USERS

The demand for lead derives from a unique combination of physical and chemical properties. Either alone or in combination with other elements, lead's low melting point, high specific gravity, softness, ductility and exceptional resistance to corrosion, are properties utilized in most industrial applications. In combination with other elements, lead is used in automobile batteries, in pigments, as the basis for anti-knock additives in gasoline, in ceramics, and as a stabilizer in plastics.

The ability of lead and some of its alloys to resist corrosion is the reason why it is utilized extensively throughout the industry in the form of protective coatings for roofing applications, as cable sheathing material for electric applications, and in numerous similar applications, including ornamental as well as industrial uses. As a coating material, lead offers additional advantages because of its ductility, which permits mechanical deformation while maintaining its corrosion-resistance property.

Lead's ductility is an important factor in the use of the metal and its alloys for pipe, tubing, and cable sheathing applications and in the manufacture of foil or collapsible containers. In addition, the tendency of lead to deform plastically under stress makes it useful for applications entailing sound and vibration attenuation.

The high density of lead and its compounds make it useful in numerous shielding applications, including X-ray protection and gamma-ray shielding, and in nuclear applications. Also, lead's density is an advantage in achieving high projectile penetration rates in ammunition.

Other physical properties, such as a low melting point, are advantages for solder applications and for the manufacture of type metal for printing purposes. Lead's natural lubrication and resistance to wear are useful properties in bearings for automotive, railroad, and similar applications.

Lead is extensively utilized in the lead-pigment industry because of its ability to form chemical compounds exhibiting strong coloration. Typical lead pigments are white lead, red lead, and basic lead chromate. The property of lead to form pigments in chemical combination makes it useful in the glass and ceramics industries for manufacturing enamels and glazes.

Another important property is that exhibited by alkyl-lead compounds that are used as anti-knocking additives for increasing the octane rating of gasoline. Finally, the galvanic properties of lead/lead oxide material in a sulfate/acid electrolyte account for the most important industrial application of lead : the lead-acid battery.

Refined lead consumption (tables 22.1.1, 22.1.3)

From 1963 to 1972 the Western world's consumption of refined lead rose from 2.3 to 3.1 Mt, with an average growth rate of 3 % per annum. During the same period of time, the Eastern world registered a 6.1 % average growth rate per annum, moving up from 0.6 to 1.1 Mt.

After a peak occurred in 1973 (3.3 Mt in the Western world), owing to the serious economic crisis which took place, a downward trend started which reached its highest point in 1975, when the Western world's consumption dropped to 2.7 Mt.

During the last few months of 1975, demand started to become lively again and in 1976 consumption, by accounting for 3.1 Mt, showed a partial recovery compared with 1973 and reached the same levels as registered in 1972.

The Eastern world, by contrast, was not particularly influenced by the crisis which hit the Western world and did not register drops in demand, but only a slight decrease in the average growth rate which fell to 2.9 % from 1972 to 1976.

As regards the evolution of demand in the main economic areas of the Western world, the United States, which in 1963 accounted for 31.4 % of the total, climbed to 33.0 % in 1972, with a 3.6 % average growth rate per annum.

Japan, with a 6.6 % average growth rate per annum, accounted for 7.6 % of the world demand against 5.6 % of 1963.
The other countries of the Western world, the EEC excepted, though registering growth rates in some cases higher than the general average, remained in terms of percent stationary as a whole (about 25 % of the total).
Over the period 1972-1976, the incidence of this group of countries rose, reaching 28.0 % of the total, mainly because of developments in consumption occurred in Africa.
On the contrary, the United States, with a 1.9 % average decrease per annum, fell down to 30.7 % in 1976, while Japan, still in 1976, returned to 1972 levels.

The EEC as a whole moved up from 0.9 Mt in 1963 to 1.05 Mt in 1972; it maintained the 1972 levels over the period 1973-1974, and then fell below 0.9 Mt in 1975, but recovered in 1976 practically all the consumption lost in the previous year.

Demand in the EEC has, therefore, shown a trend partly different from that of the other major economic areas of the Western world. The intensity of the expansive cycle was in fact more attenuated than both in Japan and in the United States, and the average decrease during the most recent years was more limited than that of the United States and slighly higher than that of Japan.

In the period 1963-1972, the EEC registered a 1.7 % average rise per annum, and in the following period it suffered a 0.5 % average decline. Consequently, the EEC's share of the total diminished, from 1963 to 1972, moving down from 38.7 % to 34.3 % and at this last level it remained substantially also through the following years.

The evolution of demand in the various EEC countries was differentiated. Germany F.R., with a 1.2 % average increase per annum in the period 1963-1972 and a 3.2 % decline in the following years, reduced its share of the total from just over 10 % in 1963 to 9 % in 1972 and 8 % in 1976.
The United Kingdom registered a slight decrease until 1972 (-0.2 % average per annum) and a 3.0 % average decrease in the following years.

Consequently, its share of the world total gradually diminished to 8 % in 1976 from 12 % in 1963.

In France, consumption increased by 1.9 % from 1963 to 1972, it then registered a more limited growth equal to 0.6 % per annum. This country accounts for about 7 % of world consumption.

Italy, which in 1963 accounted for 4 % of the world total, with a 8.1 % growth rate brought up its quota to 6 % in 1972. In the following years the average increase was 3.2 % and Italy's share rose to 7 % in 1976.

The other EEC countries' incidence on the total lies in general between 3.5 % and 4 %.

Total consumption of lead (tables (tables 22.1.2, 22.1.3)

Total consumption of lead in the Western world as a whole cannot be calculated as data are unavailable for a large number of countries.

However, data are available regarding the EEC, the United States, and Japan which together account for about 75 % of the Western world's consumption of refined lead.

As the use of scrap is wider in the highly industrialized countries, it may be supposed that, as regards total consumption, the above indicated percentage for the three major economic areas of the Western world is to be considered in default.

In general, though with some exceptions for certain countries, total consumption growth rates were slightly more limited compared with those relating to refined metal consumption in the period 1963-1972, while in the following years a reverse trend was registered because of a higher incidence of remelt and direct use of scrap.

Evolution of the incidence of refined lead consumption on total consumption, in terms of percent, is shown below :

	1963	1972	1976
EEC	80 %	81 %	79 %
USA	69 %	75 %	74 %
Japan	66 %	75 %	72 %

As regards scrap users and data on secondary production of lead (secondary refined lead, remelt and direct use of scrap), see section 21.2 on "Scrap availability".

In the United States, total consumption moved from 1.06 Mt in 1963 to 1.35 Mt in 1972 (+2.8 % average per annum) and to 1.3 Mt in 1976 (-1.0 % average per annum).

Japan, with a 5.1 % annual increase, climbed to nearly 310 000 tons in 1972 from approx. 200 000 tons in 1963 and, after fluctuations in the period 1973-1975, returned to 1972 levels in 1976.

In the EEC, total consumption which in 1973 was 1.1 Mt with a 1.5 % growth rate, reached 1.3 Mt in 1972. In the following period, compared to consumption of refined lead, it benefited more considerably from the favourable economic situation of 1973 and suffered less from the crisis which occurred over the two subsequent years. Finally, in 1976, total consumption returned to 1972 levels.

In the major EEC countries, compared with the trend of refined lead consumption, total consumption registered a more noticeable increase in Italy and Germany F.R. (for the latter country, however, it meant only a minor loss in consumption over the most recent years), while the opposite phenomenon occurred in France in the period 1963-1972, and finally in the United Kingdom the decrease was higher.

TABLE 22.1.1.: REFINED LEAD CONSUMPTION - 000 TONS

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Luxemburg	50.0	52.1	56.5	46.4	49.2	48.1	52.4	63.5	49.7	69.9
Denmark	18.7	17.4	19.8	27.0	22.2	20.1	18.9	22.9	18.6	20.3
France	164.2	179.3	198.5	192.5	188.4	202.0	213.7	199.4	174.1	206.9
Germany FR	259.4	288.2	314.7	308.9	286.5	273.5	293.7	265.2	224.5	240.5
Ireland	1.2	1.2	1.2	1.0	1.0	1.2	2.0	1.7	1.7	2.3
Italy	123.0	133.0	146.0	168.0	178.0	186.0	180.2	195.4	145.9	211.0
Netherlands	49.9	47.8	48.4	50.2	53.8	41.4	37.9	38.5	29.9	32.2
United Kingdom	276.3	276.8	275.3	261.7	276.7	278.4	282.2	266.4	237.8	246.1
EEC	942.7	995.8	1060.4	1055.7	1055.8	1050.7	1081.0	1053.0	882.2	1029.2
Other Europe	235.8	242.2	266.9	285.3	281.1	301.4	331.5	337.9	288.6	317.5
EUROPE	1178.5	1238.0	1327.3	1341.0	1336.9	1352.1	1412.5	1390.9	1170.8	1346.7
South Africa	24.0	23.0	20.2	23.9	27.0	25.8	26.7	30.5	40.7	34.8
Other Africa	20.0	20.0	18.0	20.0	19.0	24.0	24.0	26.0	32.2	29.3
AFRICA	44.0	43.0	38.2	43.9	46.0	49.8	50.7	56.5	72.9	64.1
India	37.0	36.5	30.2	41.5	33.0	41.0	41.4	42.9	36.0	52.2
Japan	163.3	180.7	187.6	210.5	209.7	231.0	267.3	217.4	189.4	229.8
Other Asia	35.3	38.4	39.9	43.5	46.0	42.2	52.1	72.5	72.3	70.1
ASIA	235.6	255.6	257.7	295.5	288.7	314.2	360.8	332.8	297.7	352.1
Brazil	25.0	28.0	26.0	20.9	30.4	53.0	55.2	61.9	50.8	52.8
Canada	59.2	60.0	65.5	54.6	54.7	63.7	69.1	65.2	54.4	73.3
Mexico	64.8	86.5	99.2	94.3	93.2	92.0	99.6	79.3	72.3	76.3
USA	784.5	912.0	911.3	943.3	941.6	1009.6	1093.2	1065.6	830.3	936.6
Other America	48.7	52.6	56.8	59.0	62.9	56.1	56.9	58.6	66.3	64.3
AMERICA	982.2	1139.1	1158.8	1172.1	1182.8	1274.4	1374.0	1330.6	1074.1	1203.3
OCEANIA	71.5	72.8	76.7	67.9	68.0	70.2	80.5	79.4	76.1	84.1
WESTERN WORLD	2511.8	2748.5	2858.7	2920.4	2922.4	3060.7	3278.5	3190.2	2691.6	3050.3
EASTERN WORLD	813.1	898.5	960.3	981.9	1055.2	1100.9	1150.3	1199.8	1220.9	1232.0
TOTAL	3324.9	3647.0	3819.0	3902.3	3977.6	4161.6	4428.8	4390.0	3912.5	4282.3

TABLE 22.1.2. : TOTAL CONSUMPTION OF LEAD - 000 TONS -

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Luxemburg	55.8	56.2	57.4	56.5	54.2	56.9	60.5	71.5	57.7	77.9
Denmark	18.7	17.4	19.8	27.0	22.2	20.1	18.9	22.9	18.6	20.3
France	222.4	223.7	232.1	232.0	223.0	229.0	239.8	229.1	209.6	236.8
Germany FR	292.8	331.1	376.2	377.2	354.7	340.0	366.8	343.8	297.6	319.0
Ireland	1.2	1.2	1.2	1.0	1.0	1.2	2.0	1.7	1.7	2.3
Italy	147.0	155.0	164.0	190.0	208.0	226.0	259.0	261.0	242.0	286.0
Netherlands	61.8	63.0	74.0	74.0	75.0	73.0	75.0	71.0	63.0	65.0
United Kingdom	393.3	384.3	367.1	350.3	346.4	354.9	364.1	325.3	293.1	301.0
EEC	1193.0	1231.9	1291.8	1308.0	1284.5	1301.1	1386.1	1326.3	1183.3	1308.3
Japan	212.3	238.7	253.1	279.1	286.0	307.5	347.2	289.5	259.4	309.7
USA	1143.5	1205.5	1260.4	1234.3	1298.6	1347.4	1398.2	1451.0	1176.7	1296.5

TABLE 22.1.3. : GROWTH IN THE LEAD CONSUMPTION
(Percentage per annum)

	Refined consumption		Total Consumption	
	1972/63	1976/72	1972/63	1976/72
Belgium-Luxemburg	+ 0.1	+ 9.8	+ 0.6	+ 8.2
Denmark	- 0.1	+ 0.2	- 0.1	+ 0.2
France	+ 1.9	+ 0.6	+ 1.1	+ 0.8
Germany FR	+ 1.2	- 3.2	+ 1.9	- 1.6
Ireland	(1)	(1)	(1)	(1)
Italy	+ 8.1	+ 3.2	+ 7.5	+ 6.1
Netherlands	- 1.1	- 6.1	+ 3.5	- 2.9
United Kingdom	- 0.2	- 3.0	- 1.1	- 4.0
EEC	+ 1.7	- 0.5	+ 1.5	+ 0.1
Other Europe	+ 3.4	+ 1.3		
EUROPE	+ 2.0	- 0.1		
South Africa	+ 5.5	+ 7.8		
Other Africa	+ 5.7	+ 5.1		
AFRICA	+ 5.6	+ 6.5		
India	+ 0.3	+ 6.2		
Japan	+ 6.6	- 0.1	+ 5.1	+ 0.2
Other Asia	+10.5	+ 13.5		
ASIA	+ 5.9	+ 2.9		
Brazil	+ 6.4	- 0.1		
Canada	+ 2.5	+ 3.6		
Mexico	+ 5.6	- 4.6		
USA	+ 3.6	- 1.9	+ 2.8	- 1.0
Other America	+ 0.5	+ 3.5		
AMERICA	+ 3.6	- 1.4		
OCEANIA	+ 0.6	+ 4.6		
WESTERN WORLD	+ 3.0	- 0.1		
EASTERN WORLD	+ 6.1	+ 2.9		
TOTAL	+ 3.8	+ 0.7		

(1) Insignificant data

22.2 - LEAD : TOTAL METAL CONSUMPTION BY USES
(tables 22.2.1 to 22.2.9)

Batteries

The largest use of lead is in storage batteries. This use, which registered an almost continuous development in the last decade, at present accounts for over 30 % of total consumption in the EEC, though with fluctuations sometimes also considerable in some countries compared with the overall average of this economic area. In the United States and Japan, the share held by batteries is equal to over 50 % and over 45 %, respectively, of the total.
The elasticity of demand for lead batteries with respect to lead prices apparently is extremely small.

Electric storage batteries are classified into two major categories : starting-lighting-ignition (SLI) batteries and industrial batteries, which include traction and stationary batteries. The standard SLI battery is the most common and accounts for more than 80 % of the lead battery market. Traction batteries for use in delivery vans, trucks, and recreational vehicles account for about 12 % of the battery lead used in the industrialized nations, and stationary batteries for use as standby power supplies (such as in hospitals, telephone exchanges) account for generally less than 5 % of the battery market, depending on geographical location.
To date, the lead-acid battery has proved to be commercially superior to batteries made from other materials.

Semifinished products

In the last decade, this sector registered in the EEC and the United States a notable stability in terms of percent, absorbing about 20 % and 10 %, respectively, of total lead consumption.

In Japan, by contrast, semifinished products suffered a sharp decrease, dropping from 17 % of total in 1967 to less than 10 % in the last years.

Within the EEC the trend was partly differentiated. In France, U.K., and Germany F.R. a decrease in absolute terms occurred, partially counterbalanced by an increase in lead shots in the first two countries, while in Italy a remarkable development in this sector was registered for both tubes and, above all, lead shots. The trend regarding lead shots was affected by both domestic and foreign demand. In the most recent years, in fact, about 25 % of the Italian production of lead shots was exported both directly and indirectly (cartridges).

Sheets, strips and pipes

Construction continues to be a major area of lead use. However, consumption of lead in roofing, piping and caulking in the past decades has declined.
The growing use of lead as sound barrier in partitions and ceilings of office, school and hotel buildings reflects the acceptance of this material in architectural design and has been a major factor in stabilizing overall consumption of lead sheets.

Lead waste piping and caulking is still required in many building codes and chemical plants, largely because of its pliability and corrosion resistance, but plastics are gaining in use owing to the ease of installation and lower cost.

Shots

Lead continues to be the major metal used for sporting ammunition in the form of shots and small caliber shells.

Cable sheathing

In the EEC as a whole, cable sheathing is clearly declining. This sector, in fact, which accounted for 24 % of total consumption in 1967, went down below 17 % in the last years, while in Japan it oscillated between 10 % and 12 % and in the United States it passed from 5 % to less than 3 %.

In the United States, especially, drop in consumption caused by substitution occurred at the beginning of the second half of the 50's, when cable sheathing in few years declined from approx. 11 % of the total to approx. 6 %.

Within the EEC, the downward trend was somewhat generalized though in different degrees among the various countries.
The only exception was Italy, where this sector registered a notable increase.

Lead covering permits underground and underwater cables to function without danger of interruption caused by corrosion, moisture or burrowing rodents.
Intercontinental cables continue to rely on lead, but plastic coverings have supplanted lead in less critical services.

Alloys

In the last decade, alloys registered a contradictory trend in the major economic areas. In the EEC they varied between 4 % and 5 % of total consumption, in the United States they declined from 9 % to less than 7 %, and in Japan they went up to 7 % from 5 %.

The most important alloys are those for solder applications.

Transportation requires lead in bearings where its natural qualities of lubrication and resistance to wear are the basis for applications in automotive, equipment and railroad car journals.

Anti-knock

The alkyl-lead compounds include tetraethyl lead (TEL) and tetramethyl lead (TML) whose primary function is to increase the octane rating of gasoline and reduce the knocking tendency of fuel mixtures in high compression engines.

The reduction of lead unit content in gasoline was in practice counterbalanced by the trend registered in gasoline consumption.

In fact, over the last decade, in absolute terms increases were registered in the EEC and only some downward fluctuations in the United States. It is to be noted that several states of this country still permit a maximum lead unit content in gasoline considerably higher than that allowed on average in the EEC.

As regards Japan, no disaggregated data are available on chemical products.
In relative terms, as to total consumption, in the United States this sector declined from about 20 % in 1963 to 17 % in 1976, while in the EEC it generally varied between 5 % and 6 %.

The main producing country in the EEC is the United Kingdom, followed by France and Italy. In practice all the production of the Community leads to the Octel group which is the major world producer.

Other chemical uses

Chemical uses other than anti-knock and exluding lead oxides for batteries, which are included in batteries consumption, registered in the EEC a positive trend, moving up from 11 % of total consumption to 16 %-17 %.
In the United States, by contrast, though with drops in some years, they showed a certain standstill in absolute terms, which turned into a decrease of the total consumption's share which went down to 6 %-7 % from 8 %.

As already said, no disaggregated date are available for Japan; chemical uses, however, including anti-knock, accounted in this country over the last decade for 18 % to 19 % of total consumption, with some peaks up to 24 %.

In the EEC, the F.R. of Germany and Italy, owing to the importance of their paints and ceramics sectors, respectively, assign to this sector more than 20 % of total consumption.

The largest part of lead for chemical uses is utilized for the production of oxides.
Main lead oxides uses are pigments, the preparation of corrosion-resistant lead paints and of glaze stain's in ceramics, and in lead-stabilizers in plastics.

Unspecified uses

This sector, which amounts to less than 10 % of total consumption in the EEC as a whole, the United States, and Japan, includes miscellaneous uses and some undistributed consumption for some countries.

TOTAL LEAD CONSUMPTION BY USES IN THE EEC (EXCLUDING IRELAND AND DENMARK) : TABLE 22.2.1.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis and shots	242.8	245.1	241.1	234.5	232.6	236.0	247.9	223.6	220.6	238.4
Cable sheathing	285.5	269.6	266.4	249.1	236.6	228.4	228.7	225.5	186.8	172.5
Batteries	306.8	335.4	368.9	378.6	384.0	394.2	423.7	376.7	362.2	429.7
Alloys	62.3	60.1	62.2	62.0	57.8	61.8	61.6	57.8	48.5	50.2
Anti-knock	62.8	67.8	63.1	67.5	70.3	77.7	79.7	79.8	81.9	80.6
Other chemicals	132.7	142.3	155.2	178.4	183.5	189.5	214.5	219.2	173.3	232.0
Unspecified	80.2	93.0	113.9	109.9	96.5	92.2	109.1	119.1	89.7	82.3
T o t a l	1,173.1	1,213.3	1,270.8	1,280.0	1,261.3	1,279.8	1,365.2	1,301.7	1,163.0	1,285.7
Percentage										
Semis and shots	20.7	20.2	19.0	18.3	18.4	18.4	18.1	17.2	19.0	18.6
Cable sheathing	24.3	22.2	21.0	19.5	18.8	17.9	16.8	17.3	16.1	13.4
Batteries	26.2	27.6	29.0	29.6	30.4	30.8	31.0	28.9	31.1	33.4
Alloys	5.3	5.0	4.9	4.8	4.6	4.8	4.5	4.5	4.2	3.9
Anti-knock	5.4	5.6	5.0	5.3	5.6	6.1	5.9	6.1	7.0	6.3
Other chemicals	11.3	11.7	12.2	13.9	14.5	14.8	15.7	16.8	14.9	18.0
Unspecified	6.8	7.7	8.9	8.6	7.7	7.2	8.0	9.2	7.7	6.4
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN BELGIUM-LUX. : TABLE 22.2.2.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Cable sheathing	20.0	20.0	21.5	16.6	16.5	17.4	18.4	17.0	13.2	11.8
Batteries	13.0	13.0	13.0	8.1	8.5	9.8	10.4	9.8	9.7	22.0
Chemicals	0.5	0.5	0.4	12.0	9.0	9.0	12.0	12.0	8.0	13.0
Unspecified	22.3	22.7	22.5	19.8	20.2	20.7	19.7	32.7	26.8	31.1
T o t a l	55.8	56.2	57.4	56.5	54.2	56.9	60.5	71.5	57.7	77.9
percentage										
Cable sheathing	35.8	35.6	37.5	29.4	30.4	30.6	30.4	23.8	22.9	15.2
Batteries	23.3	23.1	22.6	14.3	15.7	17.2	17.2	13.7	16.8	28.2
Chemicals	0.9	0.9	0.7	21.2	16.6	15.8	19.8	16.8	13.9	16.7
Unspecified	40.0	40.4	39.2	35.1	37.3	36.4	32.6	45.7	46.4	39.9
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN FRANCE : TABLE 22.2.3.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	36.2	34.2	33.0	33.1	32.0	32.4	31.0	28.3	24.4	24.8
Shots	5.7	9.2	10.0	10.0	9.0	8.4	7.9	9.0	8.3	7.1
Cable sheathing	47.5	46.7	42.0	37.7	37.0	37.8	41.1	40.2	34.1	37.1
Batteries	74.0	76.0	86.7	86.7	87.0	84.0	90.0	85.0	86.0	103.0
Alloys	18.5	16.4	17.0	15.7	14.5	15.0	14.8	13.3	11.5	11.0
Anti-knock	12.5	13.0	13.5	11.8	11.0	12.9	13.5	13.5	13.6	14.0
Other chemicals	24.3	22.1	22.8	30.5	28.0	32.0	34.5	32.3	25.2	32.3
Unspecified	3.7	6.1	7.1	6.5	4.5	6.5	7.0	7.5	6.5	7.5
Total	222.4	223.7	232.1	232.0	223.0	229.0	239.8	229.1	209.6	236.8
percentage										
Semis	16.3	15.3	14.2	14.3	14.4	14.2	12.9	12.3	11.6	10.5
Shots	2.6	4.1	4.3	4.3	4.0	3.7	3.3	3.9	4.0	3.0
Cable sheathing	21.4	20.9	18.1	16.2	16.6	16.5	17.2	17.6	16.3	15.7
Batteries	33.3	34.0	37.4	37.4	39.0	36.7	37.5	37.1	41.0	43.5
Alloys	8.3	7.3	7.3	6.8	6.5	6.5	6.2	5.8	5.5	4.6
Anti-knock	5.6	5.8	5.8	5.1	4.9	5.6	5.6	5.9	6.5	5.9
Other chemicals	10.9	9.9	9.8	13.1	12.6	14.0	14.4	14.1	12.0	13.6
Unspecified	1.6	2.7	3.1	2.8	2.0	2.8	2.9	3.3	3.1	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN GERMANY F.R. : TABLE 22.2.4.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis / Shots	57.1	58.2	61.7	54.1	52.5	52.7	52.9	50.4	47.7	50.2
Cable sheathing	76.6	84.6	85.5	80.4	74.1	67.4	54.6	52.0	41.5	36.1
Batteries	82.1	95.6	108.1	118.8	112.8	118.2	132.8	118.4	117.3	142.2
Alloys	3.5	4.0	5.0	6.5	6.3	4.9	5.7	5.5	4.5	5.2
Anti-knock	-	-	-	-	-	-	-	-	-	-
Other chemicals	52.2	58.6	64.5	68.0	68.9	70.0	79.0	80.2	66.5	82.6
Unspecified (1)	21.3	30.1	51.4	49.4	40.1	26.8	41.8	37.3	20.1	2.7
Total	292.8	331.1	376.2	377.2	354.7	340.0	366.8	343.8	297.6	319.0
percentage										
Semis / Shots	19.5	17.6	16.4	14.4	14.8	15.5	14.4	14.7	16.0	15.7
Cable sheathing	26.2	25.5	22.7	21.3	20.9	19.8	14.9	15.1	13.9	11.3
Batteries	28.0	28.9	28.7	31.5	31.8	34.8	36.2	34.5	39.4	44.6
Alloys	1.2	1.2	1.3	1.7	1.8	1.4	1.5	1.6	1.5	1.6
Anti-knock	-	-	-	-	-	-	-	-	-	-
Other chemicals	17.8	17.7	17.2	18.0	19.4	20.6	21.6	23.3	22.4	25.9
Unspecified (1)	7.3	9.1	13.7	13.1	11.3	7.9	11.4	10.8	6.8	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Including undistributed direct use of scrap until 1975

TOTAL LEAD CONSUMPTION BY USES IN ITALY : TABLE 22.2.5.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	34.0	34.4	37.0	40.3	37.8	41.4	50.3	37.5	34.8	48.9
Shots	14.5	13.6	13.0	15.2	18.7	19.2	24.7	28.3	30.3	32.3
Cable sheathing	20.5	19.0	24.0	27.0	29.5	32.0	44.8	50.2	43.5	38.5
Batteries	38.2	42.4	43.8	52.3	56.0	65.0	68.0	69.0	71.0	77.0
Alloys	5.8	5.2	5.0	5.5	6.0	5.7	6.0	6.7	6.3	6.8
Anti-knock	13.4	14.5	10.1	15.3	15.3	15.0	11.8	10.2	10.1	9.8
Other chemicals	17.5	21.8	25.7	28.3	38.9	40.0	45.2	52.0	40.6	65.4
Unspecified	3.1	4.1	5.4	6.1	5.8	7.7	8.2	7.1	5.4	7.3
T o t a l	147.0	155.0	164.0	190.0	208.0	226.0	259.0	261.0	242.0	286.0
percentage										
Semis	23.1	22.2	22.6	21.2	18.2	18.3	19.4	14.4	14.4	17.1
Shots	9.9	8.8	7.9	8.0	9.0	8.5	9.5	10.9	12.5	11.3
Cable sheathing	13.9	12.3	14.6	14.2	14.2	14.2	17.3	19.2	18.0	13.5
Batteries	26.0	27.3	26.7	27.5	26.9	28.8	26.3	26.4	29.3	26.9
Alloys	4.0	3.4	3.0	2.9	2.9	2.5	2.3	2.6	2.6	2.4
Anti-knock	9.1	9.3	6.2	8.1	7.3	6.6	4.6	3.9	4.2	3.4
Other chemicals	11.9	14.1	15.7	14.9	18.7	17.7	17.4	19.9	16.8	22.9
Unspecified	2.1	2.6	3.3	3.2	2.8	3.4	3.2	2.7	2.2	2.5
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN THE NETHERLANDS : TABLE 22.2.6.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	17.0	18.0	17.0	18.0	18.0	16.0	16.0	13.0	14.0	14.0
Cable sheathing Batteries	30.9	31.0	45.0	45.0	46.0	42.0	40.0	36.0	30.0	31.0
Chemicals	5.9	6.0	6.0	5.0	5.0	5.0	5.0	6.0	6.0	6.0
Unspecified	8.0	8.0	6.0	6.0	6.0	10.0	14.0	16.0	13.0	14.0
T o t a l	61.8	63.0	74.0	74.0	75.0	73.0	75.0	71.0	63.0	65.0
percentage										
Semis	27.5	28.6	23.0	24.3	24.0	21.9	21.3	18.3	22.2	21.5
Cable sheathing Batteries	50.0	49.2	60.8	60.8	61.3	57.5	53.3	50.8	47.7	47.8
Chemicals	9.5	9.5	8.1	6.8	6.7	6.9	6.7	8.4	9.5	9.2
Unspecified	13.0	12.7	8.1	8.1	8.0	13.7	18.7	22.5	20.6	21.5
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN THE UNITED KINGDOM : TABLE 22.2.7.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	73.2	71.3	63.2	57.5	58.1	58.8	57.7	49.8	52.5	50.2
Shots	5.1	6.2	6.2	6.3	6.5	7.1	7.4	7.3	8.6	10.9
Cable sheathing	102.4	80.7	66.4	60.4	51.9	48.6	45.8	44.5	36.5	33.5
Batteries	87.1	96.0	99.3	94.7	101.3	100.4	106.5	80.1	66.2	70.0
Alloys	34.5	34.5	35.2	34.3	31.0	36.2	35.1	32.3	26.2	27.2
Anti-knock	36.9	40.3	39.5	40.4	44.0	49.8	54.4	56.1	58.2	56.8
Other chemicals	32.3	33.3	35.8	34.6	33.7	33.5	38.8	36.7	27.0	32.7
Unspecified	21.8	22.0	21.5	22.1	19.9	20.5	18.4	18.5	17.9	19.7
T o t a l	393.3	384.3	367.1	350.3	346.4	354.9	364.1	325.3	293.1	301.0
percentage										
Semis	18.6	18.5	17.2	16.4	16.8	16.6	15.9	15.3	17.9	16.7
Shots	1.3	1.6	1.7	1.8	1.9	2.0	2.0	2.2	2.9	3.6
Cable sheathing	26.0	21.0	18.1	17.2	15.0	13.7	12.6	13.7	12.5	11.1
Batteries	22.2	25.0	27.0	27.1	29.3	28.3	29.3	24.6	22.6	23.2
Alloys	8.8	9.0	9.6	9.8	8.9	10.2	9.6	9.9	8.9	9.0
Anti-knock	9.4	10.5	10.8	11.5	12.7	14.0	14.9	17.3	19.9	18.9
Other chemicals	8.2	8.7	9.7	9.9	9.7	9.4	10.7	11.3	9.2	10.9
Unspecified	5.5	5.7	5.9	6.3	5.7	5.8	5.0	5.7	6.1	6.6
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL LEAD CONSUMPTION BY USES IN JAPAN (1) : TABLE 22.2.8.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	35.4	35.5	37.8	35.3	33.7	34.7	39.6	27.2	23.2	
Cable sheathing	25.1	26.0	27.2	27.8	29.1	27.7	28.7	21.4	29.8	
Batteries	82.2	99.6	103.6	110.4	116.7	120.2	163.1	148.2	118.3	
Alloys	11.1	13.2	14.7	18.7	18.6	22.5	24.2	17.0	19.3	
Anti-knock / Other chemicals	39.2	43.5	46.9	61.9	59.5	72.6	64.2	50.8	48.5	
Unspecified	19.3	20.9	22.9	25.0	28.4	29.8	27.4	24.9	20.3	
T o t a l	212.3	238.7	253.1	279.1	286.0	307.5	347.2	289.5	259.4	309.7
percentage										
Semis	16.7	14.9	14.9	12.6	11.8	11.3	11.4	9.4	9.0	
Cable sheathing	11.8	10.9	10.8	10.0	10.2	9.0	8.2	7.4	11.5	
Batteries	38.7	41.7	40.9	39.5	40.8	39.1	47.0	51.2	45.6	
Alloys	5.2	5.5	5.8	6.7	6.5	7.3	7.0	5.9	7.4	
Anti-knock / Other chemicals	18.5	18.2	18.5	22.2	20.8	23.6	18.5	17.5	18.7	
Unspecified	9.1	8.8	9.1	9.0	9.9	9.7	7.9	8.6	7.8	
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

(1) Refined and remelted lead

TOTAL LEAD CONSUMPTION BY USES IN U.S.A. : TABLE 22.2.9.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Semis	58.4	58.7	57.6	50.2	54.6	45.4	47.6	40.5	40.4	35.1
Shots	71.5	74.6	71.9	66.0	79.4	76.8	73.9	79.0	68.1	66.4
Cable sheathing	57.2	48.5	49.2	46.1	48.0	41.7	39.0	39.4	20.1	13.8
Batteries	423.3	466.0	528.4	538.4	616.7	659.2	698.0	772.8	634.5	612.8
Alloys	106.0	109.3	105.0	100.3	98.5	97.6	101.6	92.0	79.2	62.8
Anti-knock	224.2	237.6	246.0	252.7	239.7	252.5	249.0	227.3	189.2	217.5
Other chemicals	94.2	100.1	93.5	90.1	74.1	81.8	99.6	106.0	71.9	85.3
Unspecified	108.7	110.7	108.8	90.5	87.6	92.4	89.5	94.0	73.3	(1)202.8
T o t a l	1,143.5	1,205.5	1,260.4	1,234.3	1,298.6	1,347.4	1,398.2	1,451.0	1,176.7	1,296.5
percentage										
Semis	5.1	4.9	4.6	4.1	4.2	3.4	3.4	2.8	3.5	2.7
Shots	6.3	6.2	5.7	5.4	6.1	5.7	5.3	5.4	5.8	5.1
Cable sheathing	5.0	4.0	3.9	3.7	3.7	3.1	2.8	2.7	1.7	1.1
Batteries	37.0	38.7	41.9	43.6	47.5	48.9	49.9	53.3	53.9	47.3
Alloys	9.3	9.0	8.3	8.1	7.6	7.2	7.3	6.3	6.7	4.8
Anti-knock	19.6	19.7	19.5	20.5	18.5	18.7	17.8	15.7	16.1	16.8
Other chemicals	8.2	8.3	7.4	7.3	5.7	6.1	7.1	7.3	6.1	6.6
Unspecified	9.5	9.2	8.7	7.3	6.7	6.9	6.4	6.5	6.2	15.6
T o t a l	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Including 152,400 tons of undistributed consumption

22.3 - LEAD : ALTERNATIVE PRODUCTS

Batteries

Alternative batteries to lead-acid batteries include the nickel-zinc battery, the sodium-sulfur battery, the zinc-chlorine battery, the lithium-sulfur battery, and the lithium-aluminium/iron sulfide battery. Of these, the nickel-zinc battery is believed to be the closest to the marketplace while most of the others are at various experimental stages.

In general, the level of development of alternative power sources seems insufficient to pose a significant threat to the largest battery market sector, the SLI battery, at least in the near term. The most serious contenders in the battery field apparently are directed toward industrial battery applications, and in particular to the standby power utility sector. Potential penetration of the SLI market may be considered in the longer term.

A more immediate development in the lead battery market is the so-called 'maintenance-free battery', which requires either a low antimony content (2 % to 3 %) or a lead-calcium tin alloy (0.1 % Ca, 1 % Sn) instead of the conventional antimonial lead. Traditionally, battery grid plates have been manufactured with antimonial lead to impart mechanical stability, but because of increases in antimony prices and some technical disadvantages the content of antimony has been gradually reduced from about 10 % in the 1960's to about 5 % to-day. Further reduction to 2 % to 3 % Sb to eliminate the need for electrolyte replenishment seems to be preferred by battery manufacturers in Europe. In the United States the trend is towards the lead-calcium battery.

Although the difference in lead content between conventional antimonial-lead batteries and the maintenance-free battery is very small (of the order of 2 % to 3 % lead), the rate of market penetration of the new battery is important to consider because it will influence the secondary lead industry.

Alkyl-lead compounds

The potential substitutes of alkyl-lead compounds are alcohols and alkylates.

Increased substitution of conventional engines by alternative engine technologies that are insensitive to fuel octane rating, reduces the need for leaded gasolines.

The potential for replacement of lead in applications other than batteries and alkyl-lead compounds is presented in the following table :

Lead Use	Alternative Materials
Sheet and pipe	Plastic pipe Brass and copper tubing Galvanized steel Aluminium tubing Copper-clad iron Copper tubing Brass tubing
Cable sheathing	Plastic cable Aluminium sheathing
Pigments and primers	Titanium dioxide Iron oxide Zinc dust Zinc chromate
Type metal	Photo-offset printing Photocopying technology
Packaging and collapsible tubes	Aluminium foil Aluminium tubes Collapsible plastic tubes
Solder and alloys (e.g. terne plate)	Printed circuit technology Microminiaturization Plastic fuel tanks

Source : Stanford Research Institute.

It appears that the most serious competition derives from plastics, aluminium, and titania and from technology innovations in the printing industry.

22.4 - ZINC : ORE USERS OTHER THAN METAL PRODUCERS

The only relevant use of zinc ores other than the use in metallurgy is oxide production by the American process. The use of zinc ores in the production of lithopone and other zinc chemical products can be considered as negligible. The United States are the main users of ores for these uses. Over the last decade, in fact, they have used on the average more than 100 000 tons per annum of zinc contained in ores, with the exception of the decreases registered in 1975-1976. The amount concerning the other countries, for which in any case data are not given, is often of little importance.

Based on the information available, zinc oxide is obtained from ores in the following countries, in addition to the United States :

Mexico : 20 000 - 25 000 tons (Zn content) in 1976

France : some thousands of tons in Zn content

Yugoslavia.

22.5 - ZINC : METAL USERS AND SCRAP USERS

On heating to temperatures above 120° C, zinc changes from a brittle to a ductile metal, and after mechanical working, it retains this characteristic, even after cooling. This property renders wrought zinc useful for roofing, for the manufacture of dry battery containers, and in other applications entailing rolling or mechanical drawing operations.

The low melting point of zinc and its electropositive nature are advantageous in galvanizing applications. The electrochemical activity of zinc leads to preferential corrosion of the zinc coating, thus protecting the steel substrate. Also, the ability of zinc to react with the atmosphere and form adherent carbonate films further protects zinc and the substrate metal(s) from corrosion.

The solubility of zinc in other metals accounts for the oldest use of zinc in brasses, as well as some of its newest applications such as die casting alloys. Brass alloys containing from 5 % to 40 % zinc are known for their ductility, strength, and corrosion resistance. Zinc-based alloys for die casting are used in the manufacture of automobile parts (such as ornaments, carburators), and in numerous other consumer products, including household appliances and frames for audio and television equipment.

Other industrial applications of zinc are based on the physical, chemical, and biological properties of zinc compounds. For example, the high heat capacity and thermal conductivity of zinc oxide are important in vulcanizing to help dissipate excess heat from rubber tires and belts. The refractive index of zinc oxide, as well as its ability to absorb ultraviolet rays, accounts for the use of zinc oxide in paints and pigments. The germicidal and fungicidal properties of many inorganic and organic zinc compounds are the basis for some of zinc's pharmaceutical uses. Zinc is also used as a trace element in animal nutrition and as a plant nutrient in agriculture.

The four major areas of zinc consumption in the manufacturing field are galvanizing, die casting, brass manufacture and rolled.

In addition to metallic applications, significant quantities of zinc are consumed as zinc oxide in rubber manufacture.

Slab zinc consumption (tables 22.5.1, 22.5.3)

Consumption of slab zinc in the Western world rose, from 1963 to 1972 from 2.9 to 4.4 Mt, with an average annual growth rate of 4.8 %.
During the same period of time, the Eastern world registered an average annual growth rate of 6.7 %, thus moving from 0.7 to 1.3 Mt.
After the peak registered in 1973 (4.8 Mt) and the fall in 1975 (3.5 Mt), consumption of slab zinc in the Western world showed signs of partial recovery in 1976 (4.2 Mt), remaining however below 1972 levels.
The Eastern world, by contrast, registered only a slight decrease in the average growth rate which went down to 5.3 % in 1972-1976.

With regard to the evolution of demand in the major economic areas of the Western world, the United States, which in 1963 accounted for 34.2 % of the total, fell to 28.9 %, registering however a 2.9 % average annual increase.
In 1972, Japan, with 10 % annual growth rate, accounted for 16.1 % of the total against 10.5 % in 1963.
The other Western world countries, the EEC excepted, with growth rates usually higher than the general average, moved from 21 % of the total in 1963 to about 25 % in 1972.
During 1972 to 1976, the incidence of this last group of countries rose again, thus surpassing the 29 % of the Western world's slab zinc consumption.
The United States, on the contrary, with a 5.6 % average annual decrease, went down to 24.7 % of the total in 1976, while Japan, notwithstanding a decrease however limited to 0.6 % annual average, reached 16.8 % of the total in 1976.

The EEC as a whole moved from 1.0 Mt in 1963 to 1.35 Mt in 1972; in 1973 it registered a peak of 1.48 Mt; it then fell to about 1.0 Mt in 1975, but partially recovered in 1976, reaching over 1.2 Mt.
Demand in the EEC therefore showed a somewhat different trend compared with that of the other major economic areas of the Western world.

In the period 1963 to 1972, the EEC registered a 3.3 % average annual rise, and in the following period it showed a 2.8 % average decrease. Consequently, the EEC's share of the total fell from 1963 to 1972, moving from about 35 % to 30 %, remaining at this level also in the following years.

The evolution of demand was different in the various EEC countries. Germany F.R., with 4.4 % average annual increase in the period 1963 to 1972, and a 5.4 % decrease during the following years, reduced its share of the total from almost 10 % in 1963 to 8 % in 1976.
The United Kingdom showed a slight rise until 1972 (+0.6 % average annual) and a 3.6 % average decrease in the subsequent years. Consequently, its share of the Western world's total gradually diminished from 9 % in 1963 to 6 % in 1976.
In France, consumption rose by 4.3 % from 1963 to 1972, it then showed a small growth of 0.1 % per annum. This country accounts for 6 %-7 % of the total.
Italy, which accounted for 3.9 % of the total in 1963, with a 6.7 % growth rate raised its quota to 4.6 % in 1972. During the following years, the average growth rate was very limited (+0.1 %), Italy's share however climbed to 4.9 % in 1976.
The incidence of the other EEC countries (the major one being Belgium) on the Western world's total moved down from nearly 6 % in 1963 to 4 % in 1972.

<u>Total consumption of zinc</u> (tables 22.5.2, 22.5.3)

As is the case for lead, it is not possible to assess in a reliable enough way the total consumption of zinc in the Western world as a whole, as data are unavailable for a large number of countries. Available data pertain to the EEC (though with some reserves as far as some countries are concerned), the United States and Japan which together, with regard to slab zinc consumption, account for 75 %-80 % of the Western world. Evolution of the incidence, in terms of percent, of slab zinc consumption on total consumption is shown below :

	1963	1972	1976
EEC	75	81	75
U.S.A.	78	77	79
Japan	86	90	88

As regards scrap users and data on secondary production of zinc, see section 21.2 on "Scrap availability".

In the United States, total consumption moved from 1.3 Mt in 1963 to 1.7 Mt in 1972 (+3 % average per annum), to fall back again to 1.3 Mt in 1976 (-6.1 % per annum in 1972 to 1976).
Japan, with a 9.5 % annual increase, rose from about 350 000 tons in 1963 to 800 000 tons in 1972 and, after fluctuations registered in 1973-1975, in 1976 it returned to 1972 level.

In the EEC total consumption, which in 1963 totalled 1.35 Mt, with a 2.4 % growth rate, reached 1.66 Mt in 1972. As it was the case for lead, in the following period, compared with slab consumption, it beneficiated from the favourable economic situation of 1973 and it was less adversely affected by the crisis which took place in the two following years.
In 1976, finally, total consumption returned nearly to 1972 levels.
In the major EEC countries, in comparison with the trend of slab zinc consumption, total consumption in Italy, France and Germany F.R. registered a more limited average increase from 1963 to 1972 and a higher growth rate in the following period (for the F.R. of Germany however, it was only a matter of a lower decrease in consumption, in terms of percent).
In the U.K., on the contrary, no perceptible differences between the two rates were registered until 1972, while in the following years the decline in total consumption was more evident.

SLAB ZINC CONSUMPTION : TABLE 22.5.1.

'000 tons

		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.		115.8	118.6	150.4	127.5	130.9	139.2	180.1	194.9	103.3	119.5
Denmark		7.9	9.7	11.8	12.4	9.9	12.9	12.8	13.0	10.8	10.1
France		202.5	202.3	239.0	220.2	225.4	264.1	290.4	306.1	222.5	265.1
Germany F.R.		302.7	361.5	398.4	395.7	387.6	413.0	438.2	389.1	297.4	331.2
Ireland		1.0	1.0	5.0	5.0	3.1	3.9	4.5	2.3	2.4	2.8
Italy		141.0	155.0	167.0	178.0	170.0	203.0	220.0	202.0	150.0	204.0
Netherlands		30.3	38.4	34.3	37.2	36.6	37.2	32.3	32.7	28.6	34.3
United Kingdom		258.5	280.7	288.9	277.8	273.7	279.3	305.4	268.5	207.1	240.4
	E E C	1,059.7	1,167.2	1,294.8	1,253.8	1,237.2	1,352.6	1,483.7	1,408.6	1,022.1	1,207.4
Other Europe		189.8	218.2	264.5	265.7	267.4	298.6	321.8	342.9	306.3	336.9
	EUROPE	1,249.5	1,385.4	1,559.3	1,519.5	1,504.6	1,651.2	1,805.5	1,751.5	1,328.4	1,544.3
South Africa		49.0	45.3	45.3	54.9	53.9	55.0	61.0	69.5	63.2	57.0
Other Africa		13.0	15.3	19.2	21.7	23.8	21.2	22.5	28.2	23.3	44.0
	AFRICA	62.0	60.6	64.5	76.6	77.7	76.2	83.5	97.7	86.5	101.0
India		75.0	82.0	78.0	83.0	90.0	102.8	77.9	86.3	82.0	90.2
Japan		461.8	522.7	599.9	623.1	628.0	716.7	814.9	695.4	547.1	698.6
South Korea		8.5	9.2	10.6	11.9	13.9	20.2	23.1	25.4	23.7	33.2
Turkey		4.1	8.0	8.0	8.0	8.5	9.0	10.0	18.0	16.8	24.0
Other Asia		83.5	87.8	73.4	88.5	97.5	108.3	120.0	125.7	96.4	136.5
	ASIA	632.9	709.7	769.9	814.5	837.9	957.0	1,045.9	950.8	766.0	982.5
Brazil		39.0	46.0	50.0	66.5	66.9	74.4	80.0	93.4	82.0	95.0
Canada		106.7	114.7	116.2	106.7	114.4	136.2	134.8	134.4	149.2	133.6
Mexico		36.6	37.5	44.3	47.8	42.4	48.8	50.0	59.8	62.7	71.9
USA		1,129.5	1,220.5	1,251.7	1,074.3	1,136.9	1,285.7	1,363.9	1,168.2	839.4	1,022.5
Other America		41.0	48.1	55.0	69.0	70.3	82.9	76.8	83.9	73.2	78.0
	AMERICA	1,352.8	1,466.8	1,517.2	1,364.3	1,430.9	1,628.0	1,705.5	1,539.7	1,206.5	1,401.0
	OCEANIA	108.2	109.2	124.8	129.7	122.9	136.1	135.0	132.4	97.4	116.0
	WESTERN WORLD	3,405.4	3,731.7	4,035.7	3,904.6	3,974.0	4,448.5	4,775.4	4,472.1	3,484.8	4,144.8
	EASTERN WORLD	930.8	990.2	1,067.5	1,150.8	1,242.5	1,290.4	1,415.6	1,485.0	1,531.5	1,586.0
	TOTAL	4,336.2	4,721.9	5,103.2	5,055.4	5,216.5	5,738.9	6,191.0	5,957.1	5,016.3	5,730.8

TOTAL CONSUMPTION OF ZINC : TABLE 22.5.2.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Belgium-Lux.	125.9	136.8	150.4	148.5	132.5	156.4	180.1	194.9	129.3	154.1
Denmark	7.9	9.7	11.8	12.4	9.9	12.9	12.8	13.0	10.8	10.1
France	302.2	300.0	313.2	301.8	307.7	337.8	386.0	372.0	306.8	357.3
Germany F.R.	383.6	429.7	473.1	451.7	454.9	465.9	504.3	444.7	358.9	428.5
Ireland	1.0	1.0	5.0	5.0	3.1	3.9	4.5	2.3	2.4	2.8
Italy	195.0	208.0	228.0	249.0	248.0	275.0	303.0	290.0	245.0	307.0
Netherlands	38.0	48.0	43.0	52.0	50.0	44.0	46.0	43.0	35.0	43.0
United Kingdom	339.5	369.4	382.3	370.3	358.0	365.3	394.9	353.1	276.3	308.3
E E C	1,393.1	1,502.6	1,606.8	1,590.7	1,564.1	1,661.2	1,831.6	1,713.0	1,364.5	1,611.1
Japan	526.5	596.8	672.9	705.2	710.8	800.0	904.8	773.7	618.7	791.6
USA	1,456.9	1,583.4	1,645.8	1,425.7	1,497.5	1,672.8	1,752.6	1,517.7	1,117.5	1,297.9

GROWTH IN ZINC CONSUMPTION : TABLE 22.5.3.
(percentage per annum)

	Slab consumption		Total consumption	
	1972-1963	1976-1972	1972-1963	1976-1972
Belgium-Lux.	+ 1.3	- 3.7	+ 2.1	- 0.4
Denmark	+ 4.5	- 5.9	+ 4.5	- 5.9
France	+ 4.3	+ 0.1	+ 2.4	+ 1.4
Germany F.R.	+ 4.4	- 5.4	+ 2.7	- 2.1
Ireland	+ 3.8	- 8.0	+ 3.8	- 8.0
Italy	+ 6.7	+ 0.1	+ 5.0	+ 2.8
Netherlands	+ 1.9	- 2.0	+ 1.9	- 0.6
United Kingdom	+ 0.6	- 3.7	+ 0.5	- 4.2
E E C	+ 3.3	- 2.8	+ 2.4	- 0.8
Other Europe	+ 5.6	+ 3.1		
EUROPE	+ 3.7	- 1.7		
South Africa	+ 4.9	+ 0.9		
Other Africa	+17.9	+20.0		
AFRICA	+ 7.2	+ 7.3		
India	+ 2.7	- 3.2		
Japan	+10.0	- 0.6	+ 9.5	- 0.3
South Korea	+12.3	+13.2		
Turkey	+18.2	+27.8		
Other Asia	+15.2	+ 6.0		
ASIA	+ 9.4	+ 0.7		
Brazil	+ 7.5	+ 6.3		
Canada	+ 7.3	- 0.5		
Mexico	+ 7.5	+10.2		
USA	+ 2.9	- 5.6	+ 3.0	- 6.1
Other America	+13.2	- 1.5		
AMERICA	+ 3.8	- 3.7		
OCEANIA	+ 3.4	- 3.9		
WESTERN WORLD	+ 4.8	- 1.8		
EASTERN WORLD	+ 6.7	+ 5.3		
T O T A L	+ 5.2	- 0.0		

22.6 - ZINC : TOTAL METAL CONSUMPTION BY USES

(tables 22.6.1 to 22.6.9)

Galvanizing

Galvanizing accounts for 32 %-33 % of zinc total consumption in the EEC, although with variations in some countries.
In Japan, it generally lies between 40 % and 50 %, while in the U.S.A. it oscillates around 30 % of total consumption.

Zinc coating on steel by hot-dip galvanizing has been a major use of zinc for many years. The four main areas of applications are :

a) Sheet and strip
- batch hot dip
- continuous hot dip
- galvanizing prior to painting

b) Tube and pipe

c) Wire and rope

d) General hot dip.

The first of these, in a fully industrialized area, becomes eventually the predominant type of galvanizing. The three types of sheet and strip galvanizing occur progressively with industrialization. Pre-painted (and printed) galvanized sheet is produced in high quality, manpower expensive societies.
Galvanized tube and pipe manufactures are often considered as general galvanizing, but this is strictly the hot dip galvanizing of preformed shapes.

The construction industry is the major market for zinc-coated material. Galvanizing accounts for over 90 % of the total zinc used in protecting coverings for structural steel, roofing, siding, guttering, and reinforcing bars. Galvanized sheet is the standard duct material for air conditioning, ventilating and heating systems, and is used in channels and conduits for electrical and telephone wires in large buildings. Zinc-dust paints are growing in importance for primers.

The transportation industry is also an important consumer of zinc for galvanized steel sheet in automobile underbody parts to overcome corrosion problems.

Brass

During the last decade, this sector, which covers the second place in order of importance in the EEC, registered a remarkable stability in terms of percent, absorbing in general 26 %-27 % of total consumption, while in the U.S.A. and Japan it represents a quota below 15 % referred however to slab zinc (it is reminded that production of brass derives mainly from recycling scrap).
Regarding in particular the EEC countries, incidence on the total as to the overall average is higher in Italy and Germany F.R. and notably lower in France.

Current industrial applications of brass mill products and castings are piping, various decorative fixtures, household and construction items, transport and general engineering items and numerous other uses in the electrical industry.

Pattern of consumption for semifinished products - wire, bars, sheets, tubes, castings - and per sector of utilization, representative of industrialized countries, is illustrated hereunder :

Semifinished	
Wire	6.1 %
Bars	36.6 %
Sheets	21.0 %
Tubes	17.0 %
Castings	19.3 %
	100.0 %

Sector of utilization	
Electrical equipment	13.8 %
Building - Construction	15.0 %
Transport	15.0 %
General engineering	44.6 %
Domestic goods	11.6 %
	100.0 %

Zinc die casting

Die casting products, which account for 15 %-16 % of zinc total consumption in the EEC, are characterized by their dimensional accuracy and excellent surface finish. The number of industrial applications is vast because die casting permits mass production. The most important market sector is the automobile industry. Other applications are parts for home appliances, toys, business machines and optical and electronic appliances. The pattern of consumption by final users has been illustrated in Section 21.2.

Zinc semis

In recent years zinc semifinished products accounted for 12 %-13 % of zinc total consumption in the EEC.
Among the major EEC countries, a remarkable difference in consumption is registered due mainly to the different rate of utilization of rolled sections for roofing.

Rolled zinc applications include zinc sheets and plates for dry-cell batteries, photoengraving plates, a variety of household items (such as caps and jar tops, weather strips), coffins and for corrosion protecting anodes. In the construction industry, rolled zinc is used for roofing and similar applications such as gutters.

Oxides

Zinc oxide, which accounts for about 8 % of total consumption in the EEC, is used as a filler for rubber, in paints, in ceramic products and as a filler in floor tiles. Although vulcanizing in synthetic rubber requires less zinc oxide than in the case of natural rubber, the rubber industry continues to be the most important market sector for zinc oxide. The use of zinc oxide in paints has suffered serious competition from titanium, but zinc is still used in combination with titanium pigments.

Unspecified uses

This sector, which in the EEC as a whole is limited to 5 %-6 %, comprises miscellaneous uses and some undistributed consumption for some countries. Miscellaneous uses of zinc are various chemicals, such as a zinc chloride for soldering fluxes and for the preservation of wood, zinc sulfate for agricultural applications, zinc dust as a reducing agent in organic synthesis and, quite important, zinc dust paints as already mentioned.

TOTAL ZINC CONSUMPTION BY USES IN THE EEC (EXCLUDING IRELAND AND DENMARK) : TABLE 22.6.1.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	421.5	451.8	486.9	478.2	492.4	552.1	587.9	551.6	446.8	511.8
Brass	376.3	417.8	438.0	436.3	404.8	429.1	480.5	447.5	330.6	437.8
Zinc die casting	208.4	232.6	258.6	266.3	248.6	257.2	292.8	250.3	206.2	242.1
Zinc semis	198.1	198.6	207.4	191.5	197.9	201.4	221.9	203.3	179.3	198.4
Oxides	103.9	111.3	118.2	113.3	120.0	120.1	144.9	141.4	108.2	131.7
Unspecified	76.0	79.8	80.9	87.7	87.4	84.5	86.3	103.6	80.2	76.4
Total	1,384.2	1,491.9	1,590.0	1,573.3	1,551.1	1,644.4	1,814.3	1,697.7	1,351.3	1,598.2
Percentage										
Galvanizing	30.4	30.3	30.6	30.4	31.8	33.6	32.4	32.5	33.1	32.0
Brass	27.2	28.0	27.6	27.7	26.1	26.1	26.5	26.4	24.5	27.4
Zinc die casting	15.1	15.6	16.3	16.9	16.0	15.6	16.1	14.7	15.2	15.2
Zinc semis	14.3	13.3	13.0	12.2	12.8	12.3	12.2	12.0	13.3	12.4
Oxides	7.5	7.5	7.4	7.2	7.7	7.3	8.0	8.3	8.0	8.2
Unspecified	5.5	5.3	5.1	5.6	5.6	5.1	4.8	6.1	5.9	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL ZINC CONSUMPTION BY USES IN BELGIUM - LUX (1) : TABLE 22.6.2.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	56.3	66.8	77.1	73.5	72.4	91.8	108.4	100.9	81.6	81.8
Brass	13.0	17.0	19.0	19.7	16.8	18.6	18.4	17.0	14.1	15.7
Zinc die casting / Zinc semis	52.0	48.0	49.0	50.0	38.0	41.0	47.6	50.4	29.6	52.4
Oxides	4.6	5.0	5.3	5.3	5.3	5.0	5.7	5.0	4.0	4.2
Unspecified	-	-	-	-	-	-	-	21.6	-	-
Total	125.9	136.8	150.4	148.5	132.5	156.4	180.1	194.9	129.3	154.1
Percentage										
Galvanizing	44.7	48.8	51.3	49.5	54.6	58.7	60.2	51.8	63.1	53.1
Brass	10.3	12.4	12.6	13.3	12.7	11.9	10.2	8.7	10.9	10.2
Zinc die casting / Zinc semis	41.3	35.1	32.6	33.6	28.7	26.2	26.4	25.8	22.9	34.0
Oxides	3.7	3.7	3.5	3.6	4.0	3.2	3.2	2.6	3.1	2.7
Unspecified	-	-	-	-	-	-	-	11.1	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Some data are incomplete as some uses have not been considered

TOTAL ZINC CONSUMPTION BY USES IN FRANCE : TABLE 22.6.3.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	76.1	77.2	79.4	76.5	81.0	94.1	99.0	100.3	75.0	96.0
general	16.6	17.0	17.0	20.8	17.4	25.0	26.0	28.5	30.2	37.7
sheet and strip	37.4	37.2	35.7	28.7	37.0	40.9	43.4	41.0	25.4	34.8
wire	14.3	15.0	18.0	18.0	18.4	19.2	21.0	22.1	13.4	18.3
tube	7.8	8.0	8.7	9.0	8.2	9.0	8.6	8.7	6.0	5.2
Brass	60.5	62.8	61.3	70.0	68.9	70.4	77.8	70.8	51.7	65.3
Zinc die casting	28.2	30.5	37.5	35.2	33.6	38.5	49.6	48.6	41.6	50.3
Zinc semis	81.8	74.3	76.4	69.4	72.7	82.3	92.8	85.4	88.2	88.7
Oxides	34.8	34.7	35.5	32.0	32.5	32.5	45.9	46.7	33.0	36.6
Unspecified	20.8	20.5	23.1	18.7	19.0	20.0	20.9	20.2	17.3	20.4
Total	302.2	300.0	313.2	301.8	307.7	337.8	386.0	372.0	306.8	357.3
Percentage										
Galvanizing	25.2	25.7	25.3	25.3	26.3	27.9	25.6	27.0	24.4	26.9
general	5.5	5.6	5.4	6.9	5.6	7.4	6.7	7.7	9.8	10.6
sheet and strip	12.4	12.4	11.4	9.5	12.0	12.1	11.3	11.0	8.3	9.7
wire	4.7	5.0	5.7	5.9	6.0	5.7	5.4	6.0	4.4	5.1
tube	2.6	2.7	2.8	3.0	2.7	2.7	2.2	2.3	1.9	1.5
Brass	20.0	20.9	19.6	23.2	22.4	20.8	20.2	19.0	16.9	18.3
Zinc die casting	9.3	10.2	12.0	11.7	10.9	11.4	12.9	13.1	13.6	14.1
Zinc semis	27.1	24.8	24.4	23.0	23.6	24.4	24.0	23.0	28.7	24.8
Oxides	11.5	11.6	11.3	10.6	10.6	9.6	11.9	12.5	10.8	10.2
Unspecified	6.9	6.8	7.4	6.2	6.2	5.9	5.4	5.4	5.6	5.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL ZINC CONSUMPTION BY USES IN GERMANY F.R. : TABLE 22.6.4.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	117.5	128.9	139.4	137.8	140.4	156.2	161.4	148.6	119.3	140.8
general					60.4	63.0	62.1	55.3	53.8	54.5
sheet and strip					45.8	55.3	63.1	57.4	42.3	57.6
wire					15.6	15.1	14.4	14.5	10.1	11.2
tube					18.6	22.8	21.8	21.4	13.1	17.5
Brass	126.1	139.4	153.7	142.7	128.6	137.4	159.8	141.2	102.1	156.4
Zinc die casting	57.9	69.8	78.1	83.3	77.4	74.8	81.3	61.5	56.6	50.3
Zinc semis	56.7	62.7	69.3	58.4	68.1	62.5	63.2	58.3	48.0	52.5
Oxides	24.5	28.1	31.7	27.4	32.7	30.6	32.7	29.7	23.1	27.5
Unspecified	0.9	0.8	0.9	2.1	7.7	4.4	5.9	5.4	9.8	1.0
Total	383.6	429.7	473.1	451.7	454.9	465.9	504.3	444.7	358.9	428.5
Percentage										
Galvanizing	30.6	30.0	29.5	30.5	30.9	33.5	32.0	33.4	33.2	32.9
general					13.3	13.5	12.3	12.4	15.0	12.7
sheet and strip					10.1	11.9	12.5	12.9	11.8	13.5
wire					3.4	3.2	2.9	3.3	2.8	2.6
tube					4.1	4.9	4.3	4.8	3.6	4.1
Brass	32.9	32.5	32.5	31.6	28.3	29.5	31.7	31.8	28.5	36.5
Zinc die casting	15.1	16.2	16.5	18.4	17.0	16.1	16.1	13.8	15.8	11.7
Zinc semis	14.8	14.6	14.6	12.9	14.9	13.4	12.5	13.1	13.4	12.3
Oxides	6.4	6.5	6.7	6.1	7.2	6.6	6.5	6.7	6.4	6.4
Unspecified	0.2	0.2	0.2	0.5	1.7	0.9	1.2	1.2	2.7	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL ZINC CONSUMPTION BY USES IN ITALY : TABLE 22.6.5.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	66.0	71.0	79.0	81.0	87.0	95.0	102.0	94.5	83.8	94.2
general	24.5	30.0	35.0	37.0	40.0	43.0	48.0	43.0	39.5	46.3
sheet and strip	20.0	20.5	22.5	19.5	23.0	29.0	30.0	23.5	18.6	23.8
wire	6.0	6.0	6.5	7.0	6.0	6.0	6.0	6.0	5.4	8.7
tube	15.5	14.5	15.0	17.5	18.0	17.0	18.0	22.0	20.3	15.4
Brass	69.4	71.2	76.6	83.6	78.1	92.7	99.9	103.9	79.5	105.6
Zinc die casting	27.2	31.0	37.0	43.1	45.2	49.3	57.5	44.2	40.0	52.4
Zinc semis	10.4	11.8	10.0	12.9	11.7	10.9	13.2	12.2	10.9	12.7
Oxides	9.5	9.7	11.1	12.4	14.3	15.8	18.3	21.7	19.4	29.7
Unspecified	12.5	13.3	14.3	16.0	11.7	11.3	12.1	13.5	11.4	12.4
Total	195.0	208.0	228.0	249.0	248.0	275.0	303.0	290.0	245.0	307.0
Percentage										
Galvanizing	33.8	34.1	34.6	32.5	35.1	34.6	33.6	32.6	34.2	30.7
general	12.6	14.4	15.3	14.6	16.1	15.6	15.8	14.8	16.1	15.1
sheet and strip	10.2	9.8	9.9	7.8	9.3	10.6	9.9	8.1	7.6	7.8
wire	3.1	2.9	2.8	2.8	2.4	2.2	2.0	2.1	2.2	2.8
tube	7.9	7.0	6.6	7.0	7.3	6.2	5.9	7.6	8.3	5.0
Brass	35.6	34.2	33.6	33.6	31.5	33.7	33.0	35.8	32.5	34.4
Zinc die casting	14.0	14.9	16.2	17.3	18.2	17.9	19.0	15.2	16.3	17.1
Zinc semis	5.3	5.7	4.4	5.2	4.7	4.0	4.4	4.2	4.4	4.1
Oxides	4.9	4.7	4.9	5.0	5.8	5.7	6.0	7.5	7.9	9.7
Unspecified	6.4	6.4	6.3	6.4	4.7	4.1	4.0	4.7	4.7	4.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TOTAL ZINC CONSUMPTION BY USES IN THE NETHERLANDS (1) : TABLE 22.6.6.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	10.0	12.0	13.0	13.0	13.0	15.0	15.0	15.0	13.0	15.0
Brass	6.0	13.0	11.0	13.0	13.0	10.0	12.0	14.0	7.0	11.0
Zinc die casting	4.0	5.0	4.0	5.0	4.0	1.0	1.0	1.0	1.0	1.0
Unspecified	18.0	18.0	15.0	21.0	20.0	18.0	18.0	13.0	14.0	16.0
Total	38.0	48.0	43.0	52.0	50.0	44.0	46.0	43.0	35.0	43.0
Percentage										
Galvanizing	26.3	25.0	30.2	25.0	26.0	34.1	32.6	34.9	37.2	34.9
Brass	15.8	27.1	25.6	25.0	26.0	22.7	26.1	32.6	20.0	25.6
Zinc die casting	10.5	10.4	9.3	9.6	8.0	2.3	2.2	2.3	2.8	2.3
Unspecified	47.4	37.5	34.9	40.4	40.0	40.9	39.1	30.2	40.0	37.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Some data are incomplete as some uses have not been considered

TOTAL ZINC CONSUMPTION BY USES IN UNITED KINGDOM : TABLE 22.6.7.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	95.6	95.9	99.0	96.4	98.6	100.0	102.1	92.3	74.1	84.0
general	36.6	37.3	36.7	36.7	39.0	36.2	36.5	35.4	34.0	35.9
sheet and strip	29.2	28.2	33.1	30.5	31.1	36.8	36.2	32.8	16.8	25.8
wire	18.4	18.6	18.1	18.6	18.3	17.5	19.6	17.7	16.7	15.9
tube	11.4	11.8	11.1	10.6	10.2	9.5	9.8	6.4	6.6	6.4
Brass	101.3	114.4	116.4	107.3	99.4	100.0	112.6	100.6	76.2	83.8
Zinc die casting	65.1	72.3	77.5	74.7	69.4	73.1	79.6	69.8	52.2	61.9
Zinc semis	23.2	25.8	27.2	25.8	26.4	25.2	28.9	22.2	17.4	18.3
Oxides	30.5	33.8	34.6	36.2	35.2	36.2	42.3	38.3	28.7	33.7
Unspecified	23.8	27.2	27.6	29.9	29.0	30.8	29.4	29.9	27.7	26.6
Total	339.5	369.4	382.3	370.3	358.0	365.3	394.9	353.1	276.3	308.3
Percentage										
Galvanizing	28.2	25.9	25.9	26.0	27.5	27.4	25.9	26.1	26.8	27.3
general	10.8	10.1	9.6	9.9	10.9	9.9	9.2	10.0	12.3	11.6
sheet and strip	8.6	7.6	8.7	8.2	8.7	10.0	9.2	9.3	6.1	8.4
wire	5.4	5.0	4.7	5.0	5.1	4.9	5.0	5.0	6.0	5.2
tube	3.4	3.2	2.9	2.9	2.8	2.6	2.5	1.8	2.4	2.1
Brass	29.8	31.0	30.4	29.0	27.8	27.4	28.5	28.5	27.6	27.2
Zinc die casting	19.2	19.6	20.3	20.2	19.4	20.0	20.2	19.8	18.9	20.1
Zinc semis	6.8	7.0	7.1	6.9	7.4	6.9	7.3	6.3	6.3	5.9
Oxides	9.0	9.1	9.1	9.8	9.8	9.9	10.7	10.8	10.4	10.9
Unspecified	7.0	7.4	7.2	8.1	8.1	8.4	7.4	8.5	10.0	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SLAB ZINC CONSUMPTION BY USES IN JAPAN : TABLE 22.6.8.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	260.8	287.7	327.6	337.3	338.4	335.7	360.7	312.4	306.0	325.6
Brass	60.3	65.8	73.2	76.9	76.4	89.9	104.7	74.6	73.2	99.6
Zinc die casting	82.3	98.3	118.1	115.5	115.4	143.9	154.3	134.0	81.8	120.2
Zinc semis	24.4	29.2	31.6	35.6	26.9	31.8	39.2	25.4	36.2	33.3
Oxides	13.4	15.6	16.0	19.8	18.4	19.1	21.0	19.2	14.7	18.4
Unspecified	20.6	26.1	33.4	38.0	52.5	96.3	135.0	129.8	35.2	101.5
Total	461.8	522.7	599.9	623.1	628.0	716.7	814.9	695.4	547.1	698.6
Percentage										
Galvanizing	56.6	55.0	54.6	54.1	53.9	46.8	44.3	44.9	55.9	46.6
Brass	13.0	12.6	12.2	12.4	12.2	12.5	12.8	10.7	13.4	14.3
Zinc die casting	17.8	18.8	19.7	18.5	18.4	20.1	18.9	19.3	15.0	17.2
Zinc semis	5.3	5.6	5.3	5.7	4.3	4.4	4.8	3.6	6.6	4.8
Oxides	2.9	3.0	2.6	3.2	2.9	2.7	2.6	2.8	2.7	2.6
Unspecified	4.4	5.0	5.6	6.1	8.3	13.4	16.6	18.7	6.4	14.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SLAB ZINC CONSUMPTION BY USES IN USA (1) : TABLE 22.6.9.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
'000 tons										
Galvanizing	428.6	452.5	447.6	430.2	430.7	470.1	511.5	474.7	341.9	367.8
general	118.4	114.2	114.8	114.0	112.9	116.9	126.7	131.3	107.9	83.1
sheet and strip	218.6	247.9	243.7	229.7	231.6	266.8	292.0	264.0	168.6	220.9
wire	35.3	32.7	29.3	28.0	27.1	27.9	31.1	25.0	22.6	23.6
tube	56.3	57.7	59.8	58.5	59.1	58.5	61.7	54.4	42.8	40.2
Brass	119.3	146.9	162.8	115.9	136.5	174.3	179.3	164.7	104.6	148.7
Zinc base alloys	485.5	510.7	522.9	420.6	468.2	526.0	553.9	399.4	303.2	363.6
Zinc semis	41.2	44.4	44.1	37.3	35.3	41.0	37.0	35.7	24.8	27.1
Oxides	27.0	31.7	37.6	39.8	36.3	47.2	56.0	59.3	35.4	35.4
Unspecified	33.0	39.1	41.8	33.0	30.7	28.1	26.7	34.4	29.5	79.9 (2)
Total	1,134.6	1,225.3	1,256.8	1,076.8	1,137.7	1,286.7	1,364.4	1,168.2	839.4	1,022.5
Percentage										
Galvanizing	37.8	36.9	35.6	39.9	37.9	36.5	37.5	40.6	40.7	36.0
general	10.4	9.3	9.1	10.6	9.9	9.1	9.3	11.2	12.8	8.1
sheet and strip	19.3	20.2	19.4	21.3	20.4	20.7	21.4	22.6	20.1	21.6
wire	3.1	2.7	2.3	2.6	2.4	2.2	2.3	2.1	2.7	2.3
tube	5.0	4.7	4.8	5.4	5.2	4.5	4.5	4.7	5.1	3.9
Brass	10.5	12.0	13.0	10.8	12.0	13.5	13.1	14.1	12.5	14.5
Zinc base alloys	42.8	41.7	41.6	39.1	41.1	40.9	40.6	34.2	36.1	35.6
Zinc semis	3.6	3.6	3.5	3.4	3.1	3.2	2.7	3.1	3.0	2.6
Oxides	2.4	2.6	3.0	3.7	3.2	3.7	4.1	5.1	4.2	3.5
Unspecified	2.9	3.2	3.3	3.1	2.7	2.2	2.0	2.9	3.5	7.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Up to 1973 including some remelted zinc; (2) Including 49,400 tons of undistributed consumption

22.7 - ZINC : ALTERNATIVE PRODUCTS

Potential substitutes for zinc in galvanizing are the corrosion-resistant steels and other coating materials such as paints and aluminium. Corrosion-resistant steels have limited applications. Composition of alternative coating materials is justified in specific applications - large surfaces - and is influenced by the total cost of corrosion protection. Paints have generally lower material costs, but their application is labour intensive and the maintenance costs of a painted structure are higher, and therefore overall costs tend to favour galvanizing.

Aluminium-zinc alloy coated steel strip by the hot dip process has proved to be more convenient in respect of zinc coated steel for certain markets such as roofing and walling. In Australia approximately 40 % of all zinc coated steel goes to these applications. Potential substitutes of galvanized products, particularly sheets and pipes, are aluminium, plastics, stainless steel, and copper.

Zinc die casting

Aluminium and plastics are competitors to zinc in any die-cast application. The relative cost per unit product becomes an important consideration in determining which material will be used.
The apparent advantage of zinc - unit price - over aluminium and plastics is seriously reduced because of the lighter weight of die-cast parts made from these competing materials.

The development and trend toward thin-wall die cast products have improved zinc alloys competitiveness in the car industry, as they are lighter in weight and contain less zinc per unit volume.
Less important substitutes are magnesium castings.

Brass products

The principal substitute of brass applications are aluminium and its alloys, stainless steels, iron and plastics in building, marine hardware, plumbing goods and bearings.

Magnesium can substitute zinc in applications based on the electropositive nature of the metal : dry battery cases, photoengraving plates, sacrificial anodes.

P A R T 2 . 3

INTERNATIONAL TRADE

23.1 - LEAD

The prominent features of world consumption of lead are that, with the exception of the United States, major users are not major producers, and that most of the trade takes place among the industrially developed countries of the Western world. The U.S.S.R., China, and the Eastern European countries are important producers and consumers of lead, but as a group they are not major importers or exporters of the metal.

A comparison of the percentage of mine production with that of refined lead consumed in selected countries illustrates that the United States, Western Europe, and Japan are net importers, and Canada, Australia, and others are net exporters.

Australia is the most important net exporter of lead in all forms, with most of the lead exports in the form of bullion and refined lead. Canada is another important net exporter of lead, and two-thirds of that is in the form of concentrates.

The most important net importers of lead are the United States, Japan, West Germany, Italy, the United Kingdom, and France, which together account for almost 80 % of all net imports of lead in all forms. France, Japan, and West Germany all rely on concentrate imports to meet well over half their total import requirements. The reverse is true for Italy, the United Kingdom, and the United States, which rely primarily on lead-metal imports, both as bullion and refined lead.

23.11 - Lead concentrates

In the last decade, the international trade of lead concentrates (table 23.1.1), expressed in metal content, varied between 550 000 and 600 000 tons (about 20 % of the Western world's production), registering however some decreases in certain years.
The major exporters (Canada and Peru) provide for approx. 60 % of world exports.
Australia, Ireland, Greenland, and Sweden together account for about 30 % of exports.

WORLD TRADE OF LEAD CONCENTRATES - METAL CONTENT : TABLE 23.1.1. '000 TONS

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
IMPORTS										
Belgium - Lux.	54,9	60,6	51,1	56,4	43,3	56,0	51,3	48,8	41,2	62,2
France	90,0	89,9	86,6	96,5	105,0	111,9	105,3	116,1	90,9	63,0
Germany F.R.	127,2	141,7	131,4	160,6	126,4	113,8	92,0	104,0	118,5	96,6
Italy	13,6	31,6	20,1	20,8	18,3	16,1	25,0	39,7	8,9	13,0
United Kingdom	24,9	50,0	46,9	35,4	43,0	22,8	30,6	42,6	29,6	12,7
Austria	2,4	2,6	2,5	4,6	3,7	4,5	4,1	3,9	5,2	6,5
South Africa					-	6,6	6,2	15,3	0,6	3,5
Japan	77,0	78,0	119,3	136,2	143,4	127,9	149,1	145,0	121,9	119,3
U.S.A.	112,5	87,1	99,0	101,7	59,9	92,1	93,0	85,5	79,4	69,4
Total *	502,5	541,5	556,9	612,2	543,0	551,7	556,6	600,9	496,2	446,2
EXPORTS										
Belgium - Lux	0,6	-	0,7	10,0	1,0	-	0,3	2,7	-	-
France	2,4	2,5	3,0	1,4	0,7	-	-	-	5,2	-
Germany F.R.	3,4	3,2	4,6	1,2	1,6	1,0	0,4	2,3	2,1	4,4
Ireland	57,0	65,0	62,0	64,0	50,0	53,0	54,0	35,0	30,0	30,0
Italy	2,2	2,2	4,9	8,6	9,6	15,4	7,7	8,1	13,1	17,6
Finland	3,8	4,6	3,0	6,2	1,4	4,4	5,5	1,8	-	3,8
Greece	6,7	7,9	7,0	9,5	7,1	7,3	9,6	17,1	7,8	18,0
Greenland	-	-	-	-	-	-	-	26,4	26,0	25,2
Norway	3,4	3,3	3,8	3,4	2,8	3,1	3,4	2,5	1,4	2,8
Sweden	20,5	27,6	26,7	26,9	40,2	31,4	32,5	26,6	27,5	34,8
Morocco	62,2	57,4	40,8	47,6	43,4					
South Africa	3,2	-	0,9	4,3	1,2	3,0	0,9	-	1,8	1,2
Bolivia	20,0	20,0	25,0	26,0	23,2	20,4	20,4	20,0	20,0	20,0
Canada	114,5	130,5	127,2	150,5	180,8	162,0	201,8	194,1	211,9	140,9
Honduras	6,0	16,8	11,6	11,6	13,7	16,2	18,4	16,8	17,4	20,0
Mexico	0,6	0,8	0,8	0,9	0,3	0,1	1,9	10,4	10,0	10,0
Peru	73,8	74,8	81,5	95,6	145,7	165,7	105,2	86,0	70,0	70,0
Australia	88,2	85,0	69,5	80,3	48,2	37,9	43,2	33,9	39,8	32,0
Total *	468,5	501,6	473,0	548,0	570,9	520,9	505,2	483,7	484,0	430,7

* Total shown concerns the reported countries only

In general Japan imports about 25 % of international trade and Germany and France 20 % each, while the United States oscillate around 15 %. Belgium, the United Kingdom, and in a more limited way Italy account for almost all the remaining part.

An interesting feature of the export trade in lead concentrate is that most exporters do not rely on a single market for their product. The exceptions are Canada, which exports more than 60 % of its lead concentrates to Japan, and Sweden, which relies on West Germany for 70 % of its concentrate exports.

Lead importers of concentrate also obtain their supplies from several sources, none of which accounts for more than 50 % of their needs. Again the exception is Japan which relies on Canada for 70 % of its concentrate requirements. It is significant that no major importing country relies heavily on imports from the less developed countries. With the exception of the United States and France, none of the developing countries individually supplies more than 20 % of the needs of an importing nation. Even the United States, France, and the United Kingdom rely for less than 50 % on concentrate supplies from a less developed country.

23.12 - <u>Lead bullion</u>

In the last decade the international trade of lead bullion (table 23.1.2) registered an upward trend, although with some fluctuations, moving from 120 000-150 000 tons in 1967 to 220 000-260 000 tons in 1976, equivalent to about 10 % in the Western world's production.

Australia is currently accounting for about 80 % of lead bullion exports, while the United Kingdom for 10 %-14 %.

With regard to the major importers, the United Kingdom and Germany accounted for 85 %-90 % of the Western world's overall imports in the last year.

WORLD TRADE OF LEAD BULLION : TABLE 23.1.2.

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
IMPORTS										
Belgium - Lux	0,4	1,3	2,4	2,4	2,2	1,7	1,2	8,0	6,9	7,0
France	4,9	2,8	2,8	2,6	2,0	1,7	1,2	1,3	7,8	3,8
Germany F.R.	39,4	35,2	55,4	71,8	80,7	60,5	83,6	76,6	84,8	60,0
Italy	2,0	2,3	0,8	1,1	19,7	30,9	4,5	3,0	9,8	9,4
Netherlands	6,1	5,1	8,0	12,3	22,3	20,7	12,6	13,6	13,1	12,0
United Kingdom	68,3	95,7	123,2	158,6	124,4	114,1	126,7	127,3	116,9	164,5
U.S.A.	0,7	0,1	1,8	0,2	-	0,8	-	0,7	0,4	6,2
Total *	121,8	142,5	194,4	249,0	251,3	230,4	229,8	230,5	239,7	262,9
EXPORTS										
Belgium - Lux	0,4	0,1	-	0,1	0,5	0,6	1,5	8,9	0,4	0,4
France	4,0	2,4	3,4	0,7	10,0	0,7	1,8	0,3	2,2	0,6
Germany F.R.	1,3	1,3	0,7	1,4	3,6	4,3	1,0	3,7	1,7	0,8
Italy	-	-	-	-	-	-	-	0,4	-	3,7
Netherlands	-	-	-	-	-	-	-	1,3	-	-
United Kingdom	25,7	34,0	32,3	39,7	41,5	22,1	31,0	24,5	24,6	16,3
Mexico	12,1	13,2	10,9	9,9	9,0	8,6	8,0	5,3	5,0	5,0
Peru	-	0,5	1,2	0,9	1,6	0,1	1,9	0,5	0,3	0,5
Australia	102,0	109,0	137,8	166,7	166,2	145,4	146,3	149,5	142,4	172,0
Total *	145,5	160,5	186,3	219,4	232,4	181,8	191,5	194,4	176,6	199,3

* Total shown concerns the reported countries only

23.13 - Refined lead

As concerns refined lead (table 23.1.3), since many countries are not provided with exhaustive data, the Western World features a notable difference between the total of imported and exported metal. On the basis of the data collected in the surveyed countries, imports of refined lead in the Western World decreased from 760 000 t/y in 1967 to 650 000 t/y in 1976, while exports for the same period increased from 810 000 to 860 000 t/y, which means 30 % of the Western World production.

Imports from the Eastern World generally fluctuated between 40 000 and 50 000 tons, while exports (excepting the fall of 1972) remained at 50-70 000 tons until 1973 and definitely got over 100 000 tons since that period.

The major part of exports is accounted for by Australia, Canada, Mexico and Peru, covering together about 45 % of overall production.

Another important group of countries is represented by Germany FR, United Kingdom and Belgium, covering together about 20 % of total production.

Among the other countries, Yugoslavia, Sweden, South and South-West Africa have a certain importance.

Chief importers are the main EEC member countries (namely Italy) and the United States.

The pattern of refined lead trade differs from that of concentrates in two important aspects. First, there is more reliance on single major buyers of refined lead by the exporting countries. Canada allocates its exports primarily to the United Kingdom and the United States, but none of the recipient countries accounts for more than half of the export market.

Peru ships about 60 % of its exports to the United States, while Mexico relies on Italy and the United States for 45 % and 20 %, respectively, of its shipments. It is interesting that Peru and Mexico - the two less developed countries in the group - rely most heavily on only a few industrialized markets for their exports, while other exporters (Australia, United Kingdom, Belgium) distribute their exports more evenly among the industrialized markets.

WORLD TRADE OF REFINED LEAD : TABLE 23.1.3.

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
IMPORTS										
Belgium - Lux	7,6	14,0	9,8	11,3	11,8	13,4	9,0	14,5	10,3	16,3
Denmark	10,7	10,9	10,0	10,8	12,0	9,2	8,4	10,2	6,2	6,5
France	34,2	43,4	54,5	47,6	39,3	38,0	35,9	41,3	48,7	50,0
Germany F.R.	40,7	52,8	55,5	53,0	43,8	57,9	49,1	47,4	32,8	45,0
Ireland	1,2	1,2	1,2	1,0	1,0	1,2	2,0	1,7	1,7	2,3
Italy	54,5	52,0	63,0	118,1	98,9	117,4	131,1	156,3	115,3	142,2
Netherlands	46,2	46,9	49,0	45,9	47,8	39,5	37,1	30,7	28,4	32,0
United Kingdom	114,8	119,1	106,0	96,9	105,8	91,6	87,1	84,5	82,3	68,4
Austria	13,0	14,7	14,6	19,3	15,4	14,8	15,5	20,2	15,9	23,0
Finland	7,7	8,0	8,7	10,3	7,6	11,7	9,4	12,7	13,0	13,2
Norway	9,5	7,5	7,7	8,2	7,7	8,7	9,6	9,2	8,2	6,6
Spain	0,5	-	0,1	5,3	2,3	3,5	6,3	22,7	6,8	9,0
Switzerland	20,2	20,2	26,0	26,0	22,9	21,8	17,0	22,4	14,4	14,7
Sweden	6,6	4,9	5,9	4,9	5,4	2,5	0,9	4,8	3,2	1,2
Jugoslavia	0,9	8,5	1,4	5,3	8,9	4,8	12,9	16,1	15,6	3,5
South Africa	5,3	4,3	7,3	6,4	8,1	9,8	6,1	3,9	3,3	4,9
India	41,1	34,8	26,1	37,3	36,9	37,5	38,3	37,9	24,0	43,9
Japan	18,1	11,6	8,4	1,7	3,6	4,3	59,6	33,7	15,8	32,2
Canada	0,4	0,1	0,1	2,0	4,2	10,5	3,6	11,3	2,0	1,9
U.S.A.	329,9	306,7	252,5	221,9	177,4	219,9	161,6	107,4	91,2	128,3
Total *	763,1	761,6	707,8	733,2	660,8	718,0	700,5	688,9	539,1	645,1
EXPORTS										
Belgium - Lux	48,6	53,4	43,1	51,1	42,4	31,9	57,0	38,8	51,2	66,4
Denmark	2,3	2,8	2,2	1,2	0,6	0,7	1,7	1,9	1,3	4,0
France	11,9	12,2	10,9	21,4	17,0	15,9	17,3	16,3	16,2	29,2
Germany F.R.	76,0	39,1	36,1	48,0	59,8	56,8	62,1	80,2	73,6	65,8
Italy	-	-	-	-	-	0,2	1,8	1,6	3,4	0,4
Netherlands	10,7	16,2	13,6	14,1	17,0	21,4	24,4	19,5	23,9	22,2
United Kingdom	39,8	60,1	94,4	97,6	89,1	95,9	86,6	92,1	55,0	60,8
Austria	2,7	1,6	2,5	1,8	2,8	0,7	0,2	0,9	0,4	0,2
Spain	-	-	0,2	0,1	-	0,3	-	0,3	1,6	1,4
Sweden	13,8	12,7	9,2	8,7	25,3	35,3	26,7	25,9	26,6	34,3
Yugoslavia	48,8	49,7	61,2	49,7	50,2	38,2	40,2	44,5	56,2	44,7
Morocco	20,1	23,0	26,3	22,5	16,1	-	-	-	-	-
South and S.W. Africa	62,6	48,9	55,2	48,3	61,0	40,3	49,2	31,9	27,1	11,2
Tunisia	11,8	13,9	14,0	15,7	15,5	13,2	23,6	22,1	20,6	20,0
Zambia	17,4	17,6	23,0	22,5	25,2	25,3	19,3	18,8	17,9	15,0
Japan	0,9	3,1	2,4	5,7	5,3	4,7	4,3	33,1	39,5	8,6
Canada	120,0	125,9	97,2	138,6	124,2	127,8	113,6	71,7	109,9	114,4
Mexico	83,9	82,0	73,0	77,6	67,3	66,6	56,0	108,7	103,1	110,0
Peru	78,9	78,6	74,4	63,1	61,1	80,1	57,1	92,1	62,7	90,0
U.S.A.	6,1	7,5	2,4	4,8	2,4	4,7	45,2	43,6	16,0	2,0
Australia	153,2	142,9	139,3	158,9	126,8	141,2	146,5	138,7	122,0	164,0
Total *	809,5	791,2	780,6	851,4	809,1	801,2	832,8	882,7	828,2	864,6
Export from Western World to Eastern World			73,9	56,2	50,6	37,0	68,9	105,0	126,9	
Import of Western World from Eastern World			45,8	44,1	40,2	52,1	51,0	51,0	35,5	

* Total shown concerns the reported countries only

The other distinguishing feature of refined lead trade is that the bulk of lead tonnage traded occurs among the industrialized nations, with the developing countries adopting a secondary role.

As was the case with lead concentrates, none of the industrialized nations relies heavily on a developing country for a major source of refined lead. Also, with the exception of the United Kingdom, no major importer in the western world obtains more than 50 % of its refined lead requirements from a single country.

There is a relative stability in refined lead trade patterns. Exporting countries have exhibited some stability in allocating exports to their most important market. With three exceptions, the assigned tonnage of refined lead has varied within a few percents for the principal outlet country. Distribution of exports to the others has shown significant variations. However, the most important export markets, as a group, have suffered few significant variations. In Western Europe, with the exception of the United Kingdom, the major exporters have allocated their exports to a traditional group of countries with little percentage variations.
The United Kingdom and Australia have decreased the present allocation of refined lead to their traditional outlets, but the latter still constitute their most significant market.

Variations in the import patterns of refined lead appear to indicate a trend towards less reliance on the part of importing countries from single sources in the developing nations. The countries that had diverse sources of supply, such as Italy and the United States, have either maintained or increased their reliance on traditional suppliers.

On the other hand, countries that depended on a developing country for a relevant part of their supplies have shifted towards the industrial nations for their requirements.

23.14 - E.E.C. trade

The E.E.C. is a net importer of lead in its various forms (table 23.1.4). Net imports rose from 500 000 tons in 1967 to over 600 000 tons during the two following years, registering a peak of 710 000 tons in 1970.

NET IMPORTS OF EEC - LEAD CONTENT : TABLE 23.1.4.

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Lead concentrate	245,0	300,9	260,9	284,5	273,1	251,2	241,8	303,1	238,7	195,5
Lead bullion	89,7	104,6	156,2	206,9	195,7	201,9	194,5	190,7	210,4	234,9
Refined lead	120,6	156,5	148,7	151,2	134,5	145,4	108,8	138,2	101,1	113,9
Lead ashes and residues	26,7	24,2	40,2	42,8	62,6	49,7	45,1	34,5	46,1	
Lead scrap	14,5	15,9	20,2	28,4	17,7	22,6	42,3	29,6	17,0	
Total	496,5	602,1	626,2	713,8	683,6	670,8	632,5	696,1	613,3	

In the following years this figure dropped considerably, went again up to 700 000 tons in 1974 and then fell to little more than 600 000 tons.

Usually net imports of lead as a whole meet approximately 50 % of total EEC consumption.
In recent years 37-44 % of net imports consisted of concentrates, 27-34 % of bullion, 17-22 % of refined lead, 5-7 % of ashes and residues and 3-4 % of scrap.

Regarding intra EEC trade for 1974, the situation has been the following (tables 23.1.5 to 23.1.9) :

- concentrates : intra EEC trade accounted for 16 % of gross EEC imports, being mainly covered by exports from Ireland to Germany FR, France and Belgium.
  Italy registered a limited export rate extra EEC.

- lead bullion : intra EEC trade accounted for 18 % of gross EEC imports, being mainly covered by exports from the United Kingdom to Germany FR and, in a minor extent, from Belgium to the Netherlands.
  Extra EEC exports are practically irrelevant.

- refined lead : intra EEC trade accounted for 39 % of gross EEC imports, being mainly covered by the production of most countries.
  The main exporters are Germany FR, United Kingdom and Belgium, the main importers being Italy, France and, again, Germany.
  Extra EEC exports equalled 31 % of gross EEC exports.

- lead scrap : intra EEC trade accounted for 69 % of gross EEC imports. In some cases the import-export rate is such as to approximately square the balance trade (France and Belgium).
  Net exporters are the Netherlands and the United Kingdom, net importers being Germany and Italy.
  Extra EEC exports do not exist.

- lead ashes and residues : intra EEC trade accounted for 61 % of gross EEC imports. The trade balance for Germany FR and France is approximately square.
  Net exporters are Italy, Netherlands and the United Kingdom, Belgium being a net importer.
  Extra EEC exports of these products do not exist.

EEC FOREIGN TRADE OF LEAD CONCENTRATES - METAL CONTENT - '000 TONS - YEAR 1974 : TABLE 23.1.5.

Exports \ Imports	Germany F.R.	France	Italy	Belgium Lux.	U.K.	EEC	Extra EEC	World total	According to Exports: E E C	According to Exports: World total
Germany F.R.	.	–	–	1,9	–	1,9	–	1,9	2,3	2,3
France	–	.	–	–	–	–	–	–	–	–
Italy	–	–	.	–	–	–	8,1	8,1	–	8,1
Netherlands	–	–	–	–	–	–	–	–	–	–
Belgium - Lux	–	–	–	.	–	–	–	–	2,7	2,7
United Kingdom	–	7,9	2,0	0,4	.	10,3	–	10,3	(1) 3,0	(1) 3,0
Ireland	15,3	18,8	–	6,5	0,6	41,2	–	41,2	35,0	35,0
Denmark	0,3	2,7	–	–	–	3,0	–	3,0	–	–
EEC	15,6	29,4	2,0	8,8	0,6	56,4	8,1	64,5	43,0	51,1
Extra EEC										
Austria	–	17,3	0,1	–	–	17,4				
Finland	1,5	–	–	0,6	–	2,1				
Greece	–	–	4,4	6,6	–	11,0				
Norway	3,2	–	–	–	–	3,2				
Sweden	21,8	1,6	–	3,6	–	27,0				
Yugoslavia	2,7	–	3,0	–	–	5,7				
S. and S.W. Africa	4,6	–	–	0,3	0,9	5,8				
Morocco	10,0	30,0	–	8,1	–	48,1				
Thailand	3,2	–	–	–	–	3,2				
Bolivia	2,1	3,8	–	3,0	1,6	10,5				
Canada	17,8	18,8	13,8	–	9,5	59,9				
Chile	1,1	0,5	–	1,6	–	3,2				
Honduras	–	0,9	–	–	–	0,9				
Peru	4,6	–	6,0	9,2	7,9	27,7				
U.S.A.	11,1	10,2	–	–	4,4	25,7				
Australia	–	–	–	0,4	14,3	14,7				
East. Countries	3,4	–	8,9	5,3	–	17,6				
Others	1,3	3,6	1,5	1,3	3,4	11,1				
T o t a l	88,4	86,7	37,7	40,0	42,0	294,8				
WORLD TOTAL	104,0	116,1	39,7	48,8	42,6	351,2				

(1) According to Eurostat - Nimexe

TABLE 23.1.6.

EEC FOREIGN TRADE OF LEAD BULLION - '000 TONS - YEAR 1974

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	EEC	Extra EEC	World total	According to Exports: E E C	According to Exports: World total
Germany F.R.	.		3,0	-	0,1	-	3,1	0,7	3,8	3,0	3,7
France	-	.	-	-	-	-	-	0,1	0,1	0,2	0,3
Italy	-		.	-	-	-	-	0,4	0,4	-	0,4
Netherlands	1,5		-	.	-	-	1,5	-	1,5	1,3	1,3
Belgium - Lux	1,2		-	7,9	.	-	9,1	0,2	9,3	8,7	8,9
United Kingdom	28,4		-	-	-	.	28,4	0,1	28,5	24,4	24,5
Ireland	-		-	-	-	-	-	-	-	-	-
Denmark	0,1		-	-	-	-	0,1	-	0,1	-	-
EEC	31,2		3,0	7,9	0,1	-	42,2	1,5	43,7	37,6	39,1
Extra EEC											
Austria	0,2		-		-	-	0,2				
Sweden	17,9		-		-	-	17,9				
Yugoslavia	0,2		-		-	-	0,2				
U.S.A.	0,3		-		7,8	-	8,1				
Australia	13,2		-		-	127,3	140,5				
North Korea	13,3		-		-	-	13,3				
Others	0,3	1,3	-	5,7	0,1	-	7,4				
Total	45,4	1,3	-	5,7	7,9	127,3	187,6				
WORLD TOTAL	76,6	1,3	3,0	13,6	8,0	127,3	229,8				

EEC FOREIGN TRADE OF REFINED LEAD - '000 TONS - YEAR 1974 : TABLE 23.1.7.

Exports \ Imports	Germany FR	France	Italy	Netherlands	Belgium-Lux	U.K.	Ireland	Denmark	EEC	EXTRA EEC Portugal	Spain	Switz.	Turkey	Germany D.R.	Others	Total	World Total	According to Exports EEC	World total
Germany F.R.	.	9,1	36,8	0,3	2,3	-	0,1	0,6	49,2	-	7,1	3,5	-	-	5,8	16,4	65,6	63,8	80,2
France	6,3	.	0,7	0,3	3,5	-	-	-	10,8	-	-	2,6	-	-	3,4	6,0	16,8	10,3	16,3
Italy	-	0,3	.	-	-	-	-	-	0,3	-	-	-	-	-	1,2	1,2	1,5	0,4	1,6
Netherlands	5,3	1,5	0,4	.	3,5	0,3	-	0,1	11,1	-	-	-	-	-	9,1	9,1	20,2	10,4	19,5
Belgium - Lux	5,6	14,6	6,2	4,9	.	-	-	-	31,3	-	-	0,2	0,2	-	4,0	4,4	35,7	34,4	38,8
United Kingdom	15,9	12,3	2,9	9,7	3,0	.	1,6	2,3	47,7	4,8	1,7	4,3	4,4	7,5	16,7	39,4	87,1	52,7	92,1
Ireland	-	-	-	-	-	0,5	.	-	0,5	-	-	-	-	-	-	-	0,5	-	-
Denmark	-	-	-	-	0,5	-	-	.	0,5	-	-	-	0,1	-	1,8	1,9	2,4	-	1,9
E E C	33,1	37,8	47,0	15,2	12,8	0,8	1,7	3,0	151,4	4,8	8,8	10,6	4,7	7,5	42,0	78,4	229,8	172,0	250,4
Extra EEC																			
Austria	0,2	-	0,2	-	-	-	-	-	0,4										
Greece	-	-	0,8	-	-	-	-	-	0,8										
Yugoslavia	-	-	1,1	-	-	-	-	-	1,1										
South Africa	1,0	-	10,7	-	-	10,3	-	1,6	23,6										
Tunisia	-	0,5	9,0	-	-	-	-	-	9,5										
Zambia	-	-	5,5	-	-	-	-	-	5,5										
Japan	-	-	-	-	-	4,1	-	-	4,1										
Canada	2,7	-	4,9	-	-	25,9	-	1,1	34,6										
Mexico	0,1	-	33,8	12,0	0,9	3,3	-	-	50,1										
Peru	0,7	0,4	15,3	-	0,2	-	-	-	16,6										
U.S.A.	2,8	1,9	6,9	0,9	0,2	0,1	-	-	12,8										
Australia	5,9	-	12,4	1,9	-	39,7	-	-	59,9										
Bulgaria	-	-	7,6	-	-	-	-	-	7,6										
Others	0,9	0,7	1,1	0,7	0,4	0,3	-	4,5	8,6										
Total	14,3	3,5	109,3	15,5	1,7	83,7	-	7,2	235,2										
WORLD TOTAL	47,4	41,3	156,3	30,7	14,5	84,5	1,7	10,2	386,6										

EEC FOREIGN TRADE OF LEAD ASHES AND RESIDUES - METAL CONTENT - YEAR 1974 : TABLE 23.1.8.

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	Denmark	EEC	Extra EEC	World total	According to exports: EEC	According to exports: World total
Germany F.R.	.	0,8	0,1	1,4	1,9	-	0,2	4,4	0,1	4,5	4,9	5,0
France	0,1	.	-	-	7,1	-	-	7,2	-	7,2	6,8	6,8
Italy	-	5,0	.	-	2,1	0,1	-	7,2	-	7,2	3,0	3,0
Netherlands	1,1	0,1	-	.	3,0	0,1	0,2	4,5	-	4,5	2,1	2,1
Belgium - Lux	1,3	-	-	-	.	-	-	1,3	-	1,3	6,4	6,4
United Kingdom	2,9	4,4	-	0,3	5,4	.	0,4	13,4	0,2	13,6	4,4	4,6
Ireland	-	-	-	-	-	-	-	-	-	-	-	-
Denmark	-	-	-	-	-	-	.	-	-	-	-	-
E E C	5,4	10,3	0,1	1,7	19,5	0,2	0,8	38,0	0,3	38,3	27,6	27,9
Extra EEC												
Norway	-	-	-	-	-	0,7	0,1	0,8				
Switzerland	0,3	0,3	0,1	-	-	-	-	0,7				
Spain	0,1	-	-	-	0,7	-	-	0,8				
Canada	0,6	0,1	0,9	-	0,9	-	0,4	2,9				
U.S.A.	0,3	-	0,1	0,4	8,6	1,9	0,2	11,5				
Australia	0,2	-	-	-	3,1	0,4	-	3,7				
Others	0,7	0,3	0,2	0,2	1,4	1,2	-	4,0				
Total	2,2	0,7	1,3	0,6	14,7	4,2	0,7	24,4				
WORLD TOTAL	7,6	11,0	1,4	2,3	34,2	4,4	1,5	62,4				

EEC FOREIGN TRADE OF LEAD SCRAP - METAL CONTENT - '000 TONS - YEAR 1974 : TABLE 23.1.9.

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	Ireland	Denmark	EEC	Extra EEC	World total	According to Exports: E E C	According to Exports: World total
Germany F.R.	.	0,9	2,6	4,3	4,1	0,5	-	0,6	13,0	0,2	13,2	12,3	12,5
France	3,0	.	6,8	0,3	0,3	-	-	-	10,4	0,1	10,5	10,6	10,7
Italy	-	-	.	-	-	-	-	-	-	-	-	-	-
Netherlands	5,6	7,6	0,6	.	2,2	0,1	-	0,4	16,5	0,1	16,6	16,3	16,4
Belgium - Lux	2,0	5,4	0,4	1,1	.	1,0	-	-	9,9	-	9,9	8,4	8,4
United Kingdom	10,1	0,4	3,5	0,7	0,8	.	0,1	0,4	16,0	0,3	16,3	17,3	17,6
Ireland	-	-	-	-	0,1	0,2	.	-	0,3	-	0,3	0,1	0,1
Denmark	0,4	-	-	-	-	-	-	.	0,4	0,1	0,5	0,3	0,4
E E C	21,1	14,3	13,9	6,4	7,5	1,8	0,1	1,4	66,5	0,8	67,3	65,3	66,1
Extra EEC													
Norway	0,2	-	-	-	-	-	-	1,9	2,1				
Sweden	0,4	-	-	4,2	-	-	-	-	4,6				
Switzerland	0,4	0,8	3,6	-	-	-	-	-	4,8				
Canada	0,2	-	0,4	3,4	-	-	-	0,1	4,1				
U.S.A.	4,4	-	3,7	1,2	0,6	0,1	-	0,4	10,4				
Others	0,1	1,2	0,3	0,4	0,5	0,2	-	0,5	3,2				
T o t a l	5,7	2,0	8,0	9,2	1,1	0,3	-	2,9	29,2				
WORLD TOTAL	26,8	16,3	21,9	15,6	8,6	2,1	0,1	4,3	95,7				

23.2 - ZINC

In the Western World, with the exception of the United States, major zinc users are not major ore producers and most trade in slab zinc occurs among the industrially developed countries. A comparison of mine production with slab consumption indicates that the United States, Japan and most of the countries in Western Europe are net importers, while Canada, Australia and others in Latin America are net exporters of zinc.

23.21 - Zinc concentrates

The international trade of zinc concentrates (table 23.2.1) expressed in metal content which was of about 1.5 Mt in 1967, attained, although with some variations, the peak of 2.2 Mt in 1974 and then dropped to 1.8-1.9 Mt (about 40 % of the Western World's production). The main exporter is Canada (providing for approximately 40 % of the World export), followed by Peru and Australia. These three countries cover about 70 % of world exports.

Up to 1972 Mexico held a remarkable quota (8-10 %) but this decreased to 4-5 % in the following years due to events in the metallurgical sector of this country.

Sweden, Greenland and Ireland are amongst the minor countries of a certain importance.
Japan imports 26-30 % of the total of the international trade of concentrates, Belgium, France and Germany FR importing about 15 % each.

The United States, which absorbed about 30 % of the total at the end of the 1960's, have dropped in the recent years to 5-7 % of the total, as a consequence of the shutdown of obsolete plants.
The remaining quota is mainly covered by the other European countries.

As in the case of lead, the major zinc concentrate exporting nations do not have a concentrated market for their product.
With the exception of Australia, which in the last few years sold 48-55 % of its concentrates in Japan, most producing nations export their concentrates to a diversified group of countries.

WORLD TRADE OF ZINC CONCENTRATES - METAL CONTENT - '000 TONS : **TABLE 23.2.1.**

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
IMPORTS										
Belgium-Lux.	276.0	267.4	250.0	205.0	256.2	233.0	284.0	253.0	262.7	234.8
France	174.4	209.1	240.0	238.4	223.3	253.2	269.8	297.7	233.2	241.1
Germany F.R.	78.7	115.3	171.3	177.7	173.5	245.0	304.1	312.6	269.1	281.2
Italy	11.2	13.7	31.6	54.4	56.3	78.4	119.2	157.9	101.8	126.5
Netherlands	45.4	52.9	56.2	49.7	53.8	43.8	59.1	113.8	166.0	154.0
United Kingdom	119.3	166.7	164.9	154.3	136.0	59.3	62.3	109.8	45.1	57.8
Austria	7.7	4.9	6.7	3.3	1.6	0.5	0.3	0.2	-	-
Norway	21.0	30.0	27.0	34.0	43.0	63.0	63.0	45.0	33.0	38.0
Spain	22.0	28.7	7.0	5.0	3.0	25.0	29.0	66.0	72.0	90.0
Sweden	-	-	-	-	-	-	2.0	0.4	-	-
South Africa	-	-	-	6.0	18.0	12.0	8.0	20.0	9.0	12.0
Japan	274.5	409.3	435.0	457.4	477.3	508.8	579.0	651.9	458.2	476.2
Canada	-	0.1	-	0.2	-	0.2	2.0	1.0	0.4	0.5
USA	484.5	495.7	546.2	477.0	310.7	231.2	180.6	217.8	131.5	88.1
Total *	1,514.7	1,793.8	1,935.9	1,862.4	1,752.7	1,753.4	1,962.4	2,247.1	1,782.0	1,800.2
EXPORTS										
Belgium-Lux.	14.1	26.2	29.3	30.0	11.9	30.3	26.6	34.4	11.3	20.0
France	0.1	15.8	7.0	2.8	-	2.7	5.2	10.4	10.3	10.1
Germany F.R.	47.5	57.1	29.5	24.4	27.0	21.5	40.2	37.2	31.3	30.9
Ireland	25.0	50.0	100.0	100.0	75.0	85.0	80.0	70.0	78.0	60.0
Italy	11.7	25.9	21.8	6.5	3.8	-	-	-	5.7	10.6
Netherlands	3.9	10.2	11.4	8.1	6.7	5.6	11.9	29.0	14.4	34.0
United Kingdom	-	-	-	0.2	-	3.1	3.6	7.4	13.3	11.1
Austria	-	-	0.4	0.6	0.1	-	1.6	2.6	2.4	2.5
Finland	-	-	-	-	-	-	-	0.7	-	-
Greece	13.0	8.0	9.0	10.0	14.0	15.0	23.0	27.0	14.0	24.0
Greenland	-	-	-	-	-	-	10.4	94.3	98.3	83.7
Norway	8.0	7.0	7.0	6.0	6.0	7.0	8.0	11.0	8.0	10.0
Spain	6.8	2.0	4.5	2.4	2.9	3.0	3.5	3.9	4.1	4.0
Sweden	63.1	70.1	79.2	88.9	104.6	107.0	111.2	114.4	103.0	125.4
Morocco	44.7	38.2	15.4	29.1	15.0	14.0	15.0	32.5	15.0	15.0
South Africa	20.0	36.0	34.3	10.0	10.0	9.0	10.0	23.0	25.0	50.0
Tunisia	6.8	-	5.3	12.4	-	20.5	15.0	9.1	9.0	9.0
Bolivia	16.0	11.0	34.2	47.0	46.0	30.0	30.0	30.0	30.0	30.0
Canada	667.4	776.4	730.0	809.2	808.4	695.1	856.5	866.7	705.1	648.2
Honduras	7.5	11.7	13.9	17.6	19.2	13.5	5.5	5.6	12.1	14.8
Mexico	154.2	152.7	159.4	173.3	138.1	156.2	117.5	107.0	63.3	100.0
Peru	240.9	248.7	253.1	267.0	344.5	399.0	367.7	355.0	322.4	350.0
Australia	151.7	163.8	191.0	246.2	185.0	142.8	223.3	212.5	177.4	250.0
Total *	1,502.4	1,710.8	1,735.7	1,891.7	1,818.2	1,760.3	1,965.7	2,083.7	1,753.4	1,893.3

* Total shown concerns the reported countries only

In fact, the trend in the past recent years has been towards increasing the diversification of exports.

The principal importers of zinc concentrates also obtain their supplies from several sources, none of which accounts for the bulk of their needs. The exceptions are Belgium, the United States, and West Germany, who rely for more than 50 % on Canadian imports. However, none of the developing countries supplies more than 35 % of the concentrate requirements of any importing country.

The trend is towards decreasing the reliance on less developed suppliers and towards diversifying the sources of supply.
Among the major importing nations, the United Kingdom is the only exception, having increased its concentrate imports from Peru, while reducing its dependence from its two most important sources in the past : Canada and Australia.

23.22 - Slab zinc

As concerns slab zinc (table 23.2.2), as in the case of refined lead, since many countries do not have exhaustive data, a notable difference exists between the total of imported and exported metal in the Western World.

On the basis of the data collected on the countries surveyed, imports of slab zinc in the Western World rose from 0.85 Mt in 1967 to 1.3 Mt in 1976, while in the same period exports rose from 0.9 Mt to 1.56 Mt.

In the last years, international trade averaged 35 % of the Western World production.

Imports from the Eastern World registered considerable fluctuations, ranging from 100 000 to 180 000 tons, while exports from the Western to the Eastern World were generally contained between 20 000 and 30 000 tons, having only reached a 60 000 tons peak in 1975.

The major part of exports is accounted for by Canada, Australia and Belgium, covering together about 50 % of the total.

WORLD TRADE OF SLAB ZINC - '000 TONS : TABLE 23.2.2.

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
IMPORTS										
Belgium-Lux.	14.2	20.0	41.7	29.2	35.0	39.3	67.0	69.6	23.9	29.1
Denmark	8.0	10.1	11.9	13.5	8.8	13.1	13.1	13.4	11.2	10.2
France	30.5	26.3	25.4	24.8	29.0	50.8	58.1	75.9	62.2	61.9
Germany F.R.	136.1	182.2	175.1	148.1	164.3	133.5	106.6	89.1	82.3	116.9
Ireland	1.0	1.0	5.0	5.0	3.1	3.9	4.5	2.3	2.4	2.8
Italy	57.9	37.8	39.0	51.3	33.0	37.6	48.5	43.0	39.2	44.3
Netherlands	14.4	16.6	16.4	14.2	21.3	19.2	31.0	42.1	25.1	26.4
United Kingdom	162.2	171.5	162.2	160.8	171.7	224.7	219.7	195.5	192.2	193.9
Austria	5.6	6.6	6.0	6.6	4.4	4.8	7.3	9.4	7.6	5.2
Finland	6.5	3.7	9.2	2.7	1.7	1.8	1.2	0.4	1.9	1.8
Greece	7.5	7.3	10.8	5.1	7.4	11.7	14.7	11.4	11.7	13.0
Norway	1.4	2.5	4.4	1.7	0.9	0.5	0.5	3.4	4.1	1.8
Sweden	31.7	35.0	39.1	34.0	34.2	38.9	40.8	40.7	42.9	39.1
Switzerland	24.5	25.8	31.0	27.4	25.9	32.8	28.4	24.9	16.9	20.2
Yugoslavia	5.2	7.5	11.7	13.2	19.3	23.7	23.3	25.4	18.5	12.9
South Africa	48.9	38.9	8.5	24.9	17.4	6.7	12.6	4.7	1.9	0.4
India	74.4	101.8	26.3	43.3	70.1	62.8	29.0	56.4	33.4	46.0
Japan	18.1	8.6	8.2	21.9	13.9	8.0	27.8	23.8	22.2	28.1
Canada	1.0	1.4	0.7	0.3	3.6	11.3	18.5	7.0	0.7	12.5
USA	201.5	276.3	294.6	245.3	289.9	474.1	537.1	489.5	345.1	648.2
Total *	850.6	980.9	927.2	873.3	954.9	1,199.2	1,289.7	1,227.9	945.4	1,314.7
EXPORTS										
Belgium-Lux.	136.2	151.4	155.5	137.3	126.8	192.6	221.7	193.6	180.2	188.0
Denmark	0.1	0.2	-	0.1	0.2	0.1	-	0.3	0.1	0.1
France	10.1	20.2	20.3	16.4	29.3	47.6	37.1	25.1	15.0	32.1
Germany F.R.	17.9	27.4	30.6	47.5	38.6	91.2	91.6	64.6	66.5	92.2
Italy	-	0.9	0.8	1.9	0.1	0.1	5.0	20.7	28.7	34.9
Netherlands	24.9	21.7	25.7	23.2	28.4	43.7	34.7	60.7	82.9	122.3
United Kingdom	10.7	22.0	13.8	11.9	7.8	13.3	20.1	7.9	13.4	7.3
Austria	6.7	4.6	1.9	0.3	0.6	0.8	1.1	0.5	0.2	0.9
Finland	0.1	0.1	0.1	8.5	56.1	67.8	64.2	66.6	78.6	107.8
Norway	36.1	50.3	41.7	40.2	42.4	49.5	54.4	45.3	32.8	46.2
Spain	13.9	19.8	4.2	3.6	21.8	5.8	2.2	2.8	30.5	34.5
Yugoslavia	5.2	30.1	30.4	21.9	19.7	21.6	33.2	38.6	50.9	47.9
Zaire	57.2	67.1	63.7	63.7	62.7	66.3	67.7	68.7	65.6	65.8
Zambia	39.8	38.9	50.6	48.2	49.5	59.5	49.0	48.7	41.6	52.3
Japan	65.2	85.2	94.5	52.6	63.0	106.6	64.0	116.0	52.8	76.1
Canada	270.0	289.1	278.9	318.8	283.2	370.4	420.7	295.4	247.2	350.5
Mexico	35.7	37.2	38.3	38.1	41.9	40.3	12.1	73.6	86.3	89.6
Peru	60.8	63.0	58.0	65.3	50.6	58.2	48.4	65.9	57.8	56.0
USA	15.3	29.9	8.4	0.3	12.1	3.9	13.3	17.5	8.1	3.2
Australia	97.1	98.7	140.6	145.3	164.0	206.1	195.1	161.6	117.7	152.7
Total *	903.0	1,057.8	1,058.0	1,045.1	1,098.8	1,445.4	1,435.6	1,374.1	1,256.9	1,560.4
Export from Western World to Eastern World			24.8	19.5	15.9	23.8	16.9	33.2	62.4	
Import of Western World from Eastern World			122.5	98.4	156.7	160.8	178.9	124.4	115.4	

* Total shown concerns the reported countries only

Another important group of countries is represented by Germany FR, Netherlands, Finland, Mexico, Peru, Zaire, Zambia, Norway and Yugoslavia.

The main importers are the United States (covering, in the last years, about 40 % of the total, with a peak of 50 % in 1976) followed by the United Kingdom and Germany FR whose imports exceed exports, these three countries together covering about 70 % of the total.

The pattern of zinc trade in metal form differs from that of concentrates in two important aspects. There is more reliance on single major buyers by the exporting countries, and the distinguishing feature of slab zinc trade is that the bulk of zinc tonnage traded occurs among the industrially developed nations, with the developing countries adopting a secondary role.

Two additional features are apparent in the case of slab zinc exports. First, with the possible exception of Mexico, most exporting countries have either maintained their traditional markets or increased them significantly, particularly Canada, Australia and Norway.
The others, including Belgium and Japan, have diversified their exports only slightly with respect to their traditional major markets.
The second feature is that, with the exception of Canada, the principal exporters of slab zinc are increasing the proportion of exports to the less developed countries. This is particularly noticeable in Australia, Belgium, Japan and Mexico.

23.23 - EEC trade

EEC is a net importer of zinc in its various forms (table 23.2.3). Net imports reached about 0.9 Mt in 1967-68, stayed at 1-1.1 Mt until 1972, increased up to 1.2-1.3 Mt in 1973 and 1974 respectively, finally dropping to 1.1 Mt the following year.

The main trend registered in the last decade is given by a major net import of concentrates (presently covering over 90 % of the total), while net imports of slab zinc have dropped (they will be soon transformed into exports) as a consequence of entering into operation of new plants in the EEC countries.

(10)

NET IMPORTS OF EEC - ZINC CONTENT : TABLE 23.2.3

'000 tons

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Zinc concentrates	602.7	639.9	715.0	725.5	774.7	764.5	931.0	1,056.4	913.6	918.7
Slab zinc	224.4	221.7	230.0	208.6	235.0	133.5	138.2	158.0	51.7	8.6
Zinc alloys	12.8	12.6	15.2	21.3	16.0	22.9	14.3	9.3	10.7	24.5
Remelted zinc	- 8.8	- 9.2	- 6.0	- 4.9	- 4.1	- 4.5	- 8.7	-13.3	- 3.2	0.5
Brass ingots	- 7.7	- 4.3	- 4.1	- 2.6	- 2.4	- 2.7	- 4.6	- 0.9	- 4.4	
Zinc ashes and residues	41.6	33.4	37.4	39.0	41.1	28.3	82.0	60.0	78.4	
Zinc scrap	7.1	6.1	5.3	4.9	8.6	9.0	10.9	17.3	16.5	
Brass scrap	10.4	23.2	26.2	30.4	15.2	13.5	27.2	25.8	20.2	
Total	882.5	923.4	1,019.0	1,022.2	1,084.1	964.5	1,190.3	1,312.6	1,083.5	

Net imports of alloy zinc are rather fluctuating while imports of scrap and residues are increasing.
Usually, net imports of zinc as a whole meet approximately 2/3 of total EEC consumption.

Regarding intra EEC trade for 1974, the situation is the following (tables 23.2.4 to 23.2.10) :

- concentrates : intra EEC trade accounted for 15 % of gross EEC imports, being mainly covered by exports from Ireland. Extra EEC exports do not exist.

- slab zinc (including remelt) : intra EEC trade accounted for 50 % of gross imports, being covered by most countries. The main exporter is Belgium, followed by the Netherlands and Germany FR. Extra EEC exports reached 30 % of gross exports.

- zinc alloys : intra EEC trade accounted for 58 % of gross imports, mainly covered by exports from Belgium. Extra EEC exports attained 40 % of gross exports.

- brass ingots : intra EEC trade accounted for 70 % of gross imports, many interchanges having been registered among the different countries. The resulting net trend is that the United Kingdom is an exporter while Italy is an importer. With respect to the restricted importance of this sector, extra EEC exports are notable.

- zinc scrap : intra EEC trade accounted for 76 % of gross imports. The main exporters are Germany FR, the Netherlands and Belgium, France being the main importer. Extra EEC exports have been limited.

- brass scrap : intra EEC trade accounted for 47 % of gross imports while extra EEC exports were irrelevant.

- zinc ashes, residues and matte : intra EEC trade accounted for 74 % of gross imports, being covered by the production of most countries. In particular, Germany FR, Italy and United Kingdom are net exporters, the Netherlands and Belgium are net importers.
  Extra EEC exports are small.

TABLE 23.2.4.

EEC FOREIGN TRADE OF ZINC CONCENTRATES - METAL CONTENT - '000 TONS - YEAR 1974

Exports \ Imports	Germany F.R.	France	Italy	Nether-lands	Belgium Lux.	U.K.	EEC	Extra EEC	World total	According to exports: EEC	According to exports: World total
Germany F.R.	.	3.2	-	24.5	9.8	-	37.5	1.3	38.8	35.9	37.2
France	-	.	9.2	-	-	-	9.2	-	9.2	10.4	10.4
Italy	0.9	-	.	-	0.7	-	1.6	-	1.6	-	-
Netherlands	4.5	-	-	.	17.7	-	22.2	-	22.2	29.0	29.0
Belgium-Lux.	7.3	22.5	4.5	0.5	.	-	34.8	0.9	35.7	33.5	34.4
United Kingdom	-	1.1	-	-	-	.	1.1	4.9	6.0	2.5	7.4
Ireland	11.4	27.7	8.0	1.5	9.8	9.3	67.7	1.4	69.1	68.6	70.0
Denmark	-	7.1	-	-	-	-	7.1	-	7.1	-	-
E E C	24.1	61.6	21.7	26.5	38.0	9.3	181.2	8.5	189.7	179.9	188.4
Extra EEC											
Greenland	-	16.5	5.4	-	1.2	-	23.1				
Greece	-	5.3	13.5	-	-	-	18.8				
Spain	1.3	3.1	1.2	-	-	-	5.6				
Sweden	36.6	16.5	-	1.7	28.0	-	82.8				
Yugoslavia	-	-	0.6	-	-	-	0.6				
Morocco	4.8	21.6	0.6	-	1.5	4.0	32.5				
S. and S.W.Africa	21.0	-	-	-	1.7	-	22.7				
Tunisia	-	2.5	0.8	-	-	-	3.3				
Zaire	-	-	-	-	1.7	-	1.7				
Iran	4.1	8.6	-	-	2.9	4.6	20.2				
Thailand	0.2	-	-	-	-	-	0.2				
Turkey	1.9	2.2	19.7	-	1.9	-	25.7				
Bolivia	2.5	2.5	-	-	-	-	5.0				
Canada	163.5	70.5	41.9	23.0	124.8	11.6	435.3				
Mexico	15.2	-	20.4	3.0	8.4	-	47.0				
Peru	17.7	70.1	19.5	8.7	6.7	38.4	161.1				
Australia	4.4	-	-	46.6	18.3	35.8	105.1				
Eastern Countries	1.0	-	-	0.2	2.8	-	4.0				
Others	14.3	16.7	12.6	4.1	15.1	6.1	68.9				
T o t a l	288.5	236.1	136.2	87.3	215.0	100.5	1,063.6				
WORLD TOTAL	312.6	297.7	157.9	113.8	253.0	109.8	1,244.8				

EEC FOREIGN TRADE OF SLAB ZINC - '000 TONS - YEAR 1974 (1) : TABLE 23.2.5.

Exports \ Imports	Germany F.R.	France	Italy	Nether-lands	Belgium Lux.	U.K.	Ireland	Denmark	EEC	Extra EEC: Greece	Portugal	Switz.	Turkey	Brasil	USA	Others	Total	World total	According to exports: EEC	World total
Germany F.R. (2)	.	7.4	10.9	12.3	3.0	11.1	0.1	1.1	45.9	0.8	-	4.4	1.5	1.2	11.1	4.5	23.5	69.4	49.3	72.8
France	4.0	.	0.9	2.0	4.1	0.8	-	-	11.8	-	0.3	2.7	0.3	0.6	3.5	3.2	10.6	22.4	14.5	25.1
Italy	1.5	1.6	.	-	0.9	-	-	-	4.0	0.6	-	2.3	1.5	0.3	6.2	6.6	17.5	21.5	3.2	20.7
Netherlands	8.9	12.2	0.6	.	9.7	28.6	-	2.0	62.0	0.1	-	1.8	0.1	0.1	0.4	1.8	4.3	66.3	63.3	67.6
Belgium-Lux.	57.2	26.4	6.1	22.7	.	22.4	0.1	1.3	136.2	2.2	4.5	2.6	2.8	12.4	23.3	15.3	63.1	199.3	130.5	193.6
United Kingdom	1.0	0.2	0.3	0.4	0.3	.	1.4	2.2	5.8	0.3	0.3	0.1	0.1	0.1	1.6	0.9	3.4	9.2	4.5	7.9
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denmark	0.3	-	0.1	-	-	-	-	.	0.4	-	-	-	-	-	-	0.1	0.1	0.5	0.2	0.3
E E C	72.9	47.8	18.9	37.4	18.0	62.9	1.6	6.6	266.1	4.0	5.1	13.9	6.3	14.7	46.1	32.4	122.5	388.6	265.5	388.0
Extra EEC																				
Finland	0.1	0.4	0.2	-	-	42.8	0.3	2.5	46.3											
Norway	7.8	4.5	-	-	-	10.9	-	2.5	25.7											
Yugoslavia	1.0	0.2	2.9	0.3	1.4	0.9	-	-	6.7											
Zaire	-	0.2	3.4	-	12.6	-	-	-	16.2											
Zambia	-	0.3	6.2	0.1	-	2.4	-	1.3	10.3											
Japan	0.3	0.3	0.9	0.4	5.2	2.4	-	0.1	9.6											
Canada	0.2	1.4	0.2	0.1	1.5	29.6	0.2	-	33.2											
Mexico	1.8	4.1	-	0.3	1.8	4.5	-	0.1	12.6											
Peru	-	-	2.4	-	0.4	-	-	-	2.8											
USA	0.5	1.5	0.3	0.5	10.4	1.3	-	-	14.5											
Australia	0.6	-	-	0.8	3.6	13.9	-	-	18.9											
Bulgaria	1.4	5.2	5.9	0.5	1.0	3.0	0.1	-	17.1											
North Korea	1.2	5.8	0.4	0.7	5.3	9.3	-	0.2	22.9											
Poland	1.0	1.2	0.9	0.2	2.1	5.7	-	0.1	11.2											
USSR	1.3	2.8	0.1	0.8	2.5	1.5	-	-	9.0											
Others	0.9	0.2	0.3	1.2	3.8	4.4	0.1	-	10.9											
Total	18.1	28.1	24.1	5.9	51.6	132.6	0.7	6.8	267.9											
WORLD TOTAL	91.0	75.9	43.0	43.3	69.6	195.5	2.3	13.4	534.0											

(1) Including remelted zinc; (2) Excluding exports to Germany D.R.

EEC FOREIGN TRADE OF ZINC ALLOYS - METAL CONTENT - '000 TONS - YEAR 1974 : TABLE 23.2.6.

Exports \ Imports	Germany F.R.	France	Italy	Nether-lands	U.K.	EEC	Extra E E C						World total	According to exports	
							Austria	Switz.	Algeria	Brazil	Others	Total		EEC	World total
Germany F.R.	•	1.2	1.3	0.4	–	2.9	1.0	1.5	–	0.4	2.4	5.3	8.2	3.0	8.3
France	0.5	•	0.8	–	–	1.3	–	0.1	1.0	–	1.2	2.3	3.6	1.9	4.2
Italy	–	–	•	0.1	–	0.1	–	0.3	–	1.0	0.2	1.5	1.6	0.3	1.8
Netherlands	0.2	0.2	0.1	•	0.2	0.7						(1)	0.7	(1)	0.3
Belgium-Lux.	2.8	4.5	4.3	–	0.1	11.7						(2)	11.7	(2)	(2)
United Kingdom	0.1	0.1	0.2	0.1	•	0.5	–	0.1	–	0.2	2.5	2.8	3.3	2.9	5.7
Ireland	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
E E C	3.6	6.0	6.7	0.6	0.3	17.2	1.0	2.0	1.0	1.6	6.3	11.9	29.1	8.1	20.3
Extra EEC															
Norway	–	–	–	–	5.8	5.8									
Yugoslavia	–	–	1.0	–	–	1.0									
Japan	0.1	–	0.4	–	2.8	3.3									
Others	–	0.1	0.9	0.3	1.0	2.3									
Total	0.1	0.1	2.3	0.3	9.6	12.4									
WORLD TOTAL	3.7	6.1	9.0	0.9	9.9	29.6									

(1) Included in the NIMEXE position 977: secret
(2) Included in slab zinc foreign trade

EEC FOREIGN TRADE OF BRASS INGOTS - ZINC CONTENT - '000 TONS - YEAR 1974 TABLE 23.2.7.

Exports \ Imports	Germany F.R.	France	Italy	Nether-lands	Belgium Lux.	U.K.	EEC	Extra E E C						World total	According to exports	
								Austria	Portugal	Sweden	Japan	Others	Total		EEC	World total
Germany F.R.	.	0.8	0.4	0.1	0.2	0.5	2.0	0.2	-	-	-	0.1	0.3	2.3	0.4	0.7
France	0.1	.	0.1	-	0.1	-	0.3	-	-	-	-	0.1	0.1	0.4	0.2	0.3
Italy	-	-	.	-	-	-	-	-	-	-	-	0.1	0.1	0.1	-	0.1
Netherlands	0.7	0.2	0.3	.	0.4	-	1.6	-	-	-	-	0.1	0.1	1.7	1.3	1.4
Belgium-Lux.	-	0.1	0.1	-	.	0.1	0.3	-	-	-	-	0.1	0.1	0.4	1.4	1.5
United Kingdom	1.0	0.1	4.2	-	-	.	5.3	-	0.3	0.8	0.6	1.3	3.0	8.3	7.8	10.8
Ireland	-	-	0.1	-	-	-	0.1	-	-	-	-	-	-	0.1	-	-
Denmark	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	-	-
E E C	1.9	1.2	5.2	0.1	0.7	0.6	9.7	0.2	0.3	0.8	0.6	1.8	3.7	13.4	11.1	14.8
Extra EEC																
Norway	0.3	-	0.1	-	-	-	0.4									
Sweden	0.2	0.1	-	-	-	-	0.3									
Switzerland	0.1	-	0.8	-	-	-	0.9									
Yugoslavia	-	-	0.5	-	-	-	0.5									
Poland	0.2	-	0.8	-	-	0.1	1.1									
Others	0.3	-	0.2	-	0.4	0.1	1.0									
Total	1.1	0.1	2.4	-	0.4	0.2	4.2									
WORLD TOTAL	3.0	1.3	7.6	0.1	1.1	0.8	13.9									

EEC FOREIGN TRADE OF ZINC SCRAP - '000 TONS - YEAR 1974 : TABLE 23.2.8.

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	EEC	Extra EEC	World total	According to exports: EEC	According to exports: Total
Germany F.R.	.	1.8	2.1	7.0	1.8	-	12.7	2.2	14.9	10.0	12.2
France	0.2	.	0.6	-	0.2	-	1.0	0.1	1.1	1.2	1.3
Italy	-	-	.	-	-	-	-	-	-	0.1	0.1
Netherlands	0.4	9.2	0.1	.	2.3	0.2	12.2	0.3	12.5	12.2	12.5
Belgium-Lux.	0.8	8.3	0.1	0.7	.	0.1	10.0	0.1	10.1	8.9	9.0
United Kingdom	0.6	2.4	0.1	0.3	0.2	.	3.6	0.1	3.7	3.3	3.4
Ireland	-	-	-	-	-	0.4	0.4	0.3	0.7	0.3	0.6
Denmark	1.7	0.2	0.1	0.2	0.1	0.1	2.4	0.7	3.1	3.1	3.8
E E C	3.7	21.9	3.1	8.2	4.6	0.8	42.3	3.5	45.8	39.1	42.9
Extra EEC											
Switzerland	0.3	0.2	0.7	-	0.1	-	1.3				
Canada	-	0.3	0.1	-	0.4	0.4	1.2				
USA	0.3	0.9	0.2	-	6.2	0.1	7.7				
Other	0.9	0.6	0.3	0.1	0.8	0.6	3.3				
Total	1.5	2.0	1.3	0.1	7.5	1.1	13.5				
WORLD TOTAL	5.2	23.9	4.4	8.3	12.1	1.9	55.8				

EEC FOREIGN TRADE OF ASHES, RESIDUES AND MATTE - ZINC CONTENT - '000 TONS - YEAR 1974 : TABLE 23.2.9.

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	EEC	Extra EEC			World total	According to exports	
								Sweden	Other	Total		EEC	World total
Germany F.R.	.	6.8	3.6	11.7	46.4	4.1	72.6	10.4	0.9	11.3	83.9	56.3	67.6
France	1.0	.	0.2	1.1	5.7	-	8.0	1.0	0.2	1.2	9.2	5.2	6.4
Italy	16.3	0.1	.	-	1.7	-	18.1	-	0.6	0.6	18.7	15.8	16.4
Netherlands	6.9	1.2	0.1	.	3.9	0.1	12.2	0.7	0.3	1.0	13.2	11.3	12.3
Belgium-Lux.	5.3	2.8	0.2	22.4	.	-	30.7	-	0.5	0.5	31.2	32.6	33.1
United Kingdom	9.7	2.1	0.2	1.0	3.8	.	16.8	-	1.0	1.0	17.8	24.6	25.6
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-
Denmark	3.9	0.2	-	0.3	0.3	0.2	4.9	-	-	-	4.9	2.7	2.7
E E C	43.1	13.2	4.3	36.5	61.8	4.4	163.3	12.1	3.5	15.6	178.9	148.5	164.1
Extra EEC													
Austria	4.5	-	0.1	-	-	-	4.6						
Finland	0.3	0.1	-	-	-	0.3	0.7						
Norway	0.3	0.4	-	-	0.4	-	1.1						
Sweden	1.2	0.1	0.1	-	0.5	0.4	2.3						
Switzerland	5.1	0.7	3.2	0.1	1.3	-	10.4						
Morocco	-	0.6	-	-	-	0.7	1.3						
Canada	1.0	0.1	1.0	0.1	0.5	1.4	4.1						
USA	2.2	0.2	1.6	-	5.3	1.0	10.3						
Eastern countries	5.7	-	0.2	2.0	2.3	-	10.2						
Others	5.4	1.0	0.7	0.7	4.5	0.8	13.1						
Total	25.7	3.2	6.9	2.9	14.8	4.6	58.1						
WORLD TOTAL	68.8	16.4	11.2	39.4	76.6	9.0	221.4						

EEC FOREIGN TRADE OF BRASS SCRAP - ZINC CONTENT - '000 TONS - YEAR 1974

TABLE 23.2.10.

Exports \ Imports	Germany F.R.	France	Italy	Netherlands	Belgium Lux.	U.K.	EEC	Extra EEC: Austria	Extra EEC: Others	Extra EEC: Total	World total	According to exports: EEC	According to exports: World total
Germany F.R.	.	0.2	3.5	0.7	0.9	0.2	5.5	0.5	0.3	0.8	6.3	5.4	6.2
France	1.4	.	0.9	0.2	1.3	0.1	3.9	-	-	-	3.9	3.9	3.9
Italy	0.2	-	.	-	-	-	0.2	-	-	-	0.2	0.5	0.5
Netherlands	2.6	-	0.4	.	1.9	0.2	5.1	-	0.3	0.3	5.4	5.6	5.9
Belgium-Lux.	0.8	0.1	0.6	0.4	.	0.1	2.0	-	-	-	2.0	2.1	2.1
United Kingdom	0.6	-	0.9	0.2	1.3	.	3.0	-	0.5	0.5	3.5	2.0	2.5
Ireland	-	-	-	-	0.2	0.3	0.5	-	-	-	0.5	0.3	0.3
Denmark	1.5	-	-	-	0.1	-	1.6	-	0.1	0.1	1.7	1.6	1.7
E E C	7.1	0.3	6.3	1.5	5.7	0.9	21.8	0.5	1.2	1.7	23.5	21.4	23.1
Extra EEC													
Switzerland	0.9	-	0.3	-	0.2	-	1.4						
Israel	0.3	0.3	-	-	-	-	0.6						
Canada	0.3	-	0.6	-	0.8	0.1	1.8						
USA	2.4	-	3.7	0.2	2.9	0.9	10.1						
Eastern countries	0.9	-	-	-	-	0.1	1.0						
Other	3.0	0.2	3.6	0.4	2.2	0.8	10.2						
Total	7.8	0.5	8.2	0.6	6.1	1.9	25.1						
WORLD TOTAL	14.9	0.8	14.5	2.1	11.8	2.8	46.9						

P A R T 2 . 4

CONSUMPTION FORECASTS

INTRODUCTION

Forecasts on consumption, both world-wide and for the Community, were formulated on a long term basis, thus covering a period sufficient to consolidate some existing trends in specific sectors (batteries, cables, alkyl lead, galvanized sheets, zinc oxides) as well as to intensify scrap recycling.

Development of the offer has also been forecast both on a world basis and for the EEC.

As a whole, demand in the Western world should increase at average annual rates lower than those registered in the past; potential ore production consequent to the new initiatives to be undertaken before 1985 is relevant as compared with present production levels, increase of metallurgical plant capacity being higher than consumption increase rates; consequently, it is expected that during the first half of the 1980's offer will potentially exceed demand.

Finally, reserves in the Western world are sufficient to create no problems in meeting concentrate demand, in relation to expected consumption levels.

24.1 - MINE PRODUCTION

The document prepared by the International Lead and Zinc Study Group on new mine and smelter projects reports the gradual opening (within 1985) on new mines for a total of 0.4 Mt lead and 1.3 Mt zinc, i.e. 16 % and 27 % of 1976 production, respectively.

Other projects known to be under consideration are reported whose capacity is difficult to estimate but which, on the basis of the reported data, is expected to be at least equal to 250 000 tons for lead and 850 000 tons for zinc.

We do not have data concerning the closing of existing mines due to depletion of resources or to other reasons; on the other hand, quantities reported for the past by the International Lead and Zinc Study Group were limited.

TABLE 24.1.1.

MINE PRODUCTION - 000 TONS

	1976	1985
LEAD		
EEC (1)	135.3	230
Other Europe	337.5	405
EUROPE	472.8	635
South and S.W. Africa	42.3	145
Other Africa	98.1	130
AFRICA	140.4	275
ASIA	155.8	200
Canada	247.1	465
Mexico	200.0	245
Peru	182.1	205
USA	566.3	710
Other America	98.6	115
AMERICA	1294.1	1740
OCEANIA	399.3	430
WESTERN WORLD	2462.4	3280
ZINC		
EEC (1)	332.3	700
Other Europe	529.1	730
EUROPE	861.4	1430
South and S.W. Africa	122.6	310
Other Africa	173.7	200
AFRICA	296.3	510
Iran	72.0	140
Japan	260.0	280
Other Asia	142.9	300
ASIA	474.9	720
Canada	1158.4	1760
Mexico	259.2	365
Peru	458.5	520
USA	476.0	600
Other America	180.5	355
AMERICA	2532.6	3600
OCEANIA	467.6	550
WESTERN WORLD	4632.8	6810

(1) Including Greenland in the forecasts

As a consequence, it is difficult to estimate the net increase of mining production on the basis of available data, even in consideration of the fact that the total capacity may be affected by the fluctuation of the economic situation.

Table 24.1.1 reports potential mining productions of the Western world until 1985 (it is not possible to cover a longer period on the basis of available data) calculated, excepting for the EEC, without taking into account the closing down of depleted mines and without considering the possible contribution of new mines now under investigation, the capacity of which has not yet been defined.

24.2 - METAL PRODUCTION

The document of the International Lead and Zinc Study Group reports the gradual entering into operation within 1985 of new metallurgical plants; consequently, the total capacity of refined lead and slab zinc will be 4.6 and 7.0 Mt, respectively, as reported in tables 24.2.1 and 24.2.2.

Assuming an actual production of 92 % as compared with capacity, offer would be in excess in both hypotheses of minimum and maximum demand.

TABLE 24.2.1.

LEAD PLANTS' CAPACITY IN 1985 - '000 TONS

	Smelters (1)	Refineries		
		Primary (1)	Secondary (2)	Total
EEC	633	816	436	1,252
Other Europe	388	348	50	398
EUROPE	1,021	1,164	486	1,650
AFRICA	250	250	-	250
Japan	256	299	-	299
Other Asia	77	94	20	114
ASIA	333	393	20	413
Canada	253	253	-	253
Mexico	260	344	-	344
Peru	90	90	-	90
USA	805	708	450	1,158
Other America	137	143	20	163
AMERICA	1,545	1,538	470	2,008
AUSTRALIA	399	230	25	255
WESTERN WORLD	3,548	3,575	1,001	4,576

(1) Including some production from secondary materials

(2) The indicated production capacity may be easily increased above all in the EEC and the USA

TABLE 24.2.2.

ZINC PLANTS' CAPACITY IN 1985 - '000 TONS

EEC		1,916
Other Europe		679
	EUROPE	2,595
South Africa		100
Other Africa		175
	AFRICA	275
Japan		985
Other Asia		340
	ASIA	1,325
Canada		780
Mexico		265
Peru		190
USA		870
Other America		270
	AMERICA	2,375
	OCEANIA	430
	WESTERN WORLD	7,000

24.3 LEAD : METAL CONSUMPTION

24.31 Review of lead forecasts available in the literature (table 24.3.1)

24.31.A - U.S. Bureau of Mines : Mineral Facts and Problems, 1975 edition (table 24.3.2)

U.S. demand for primary lead from 1973 to 2000 can be met adequately from domestic supply at little increase in price in terms of constant dollars. Total U.S. demand for lead in 2000, including secondary metal, is forecast to fall between 1.78 Mt and 3.52 Mt. Within this range, the expected level of demand in 2000 is 2.43 Mt, representing an average annual growth rate of 1.6 % between 1973 and 2000.

Rest-of-world demand for primary lead for the forecast period could be met from world supplies at the current price in constant dollars. Total rest-of-world demand for lead in 2000, including secondary metal, is forecast to lie between 7.54 Mt and 9.48 Mt, with the probable level of demand in 2000 at 9.22 Mt, representing an average annual growth rate of 2.9 % between 1973 and 2000.

Demand forecasts were based on contingency analyses of probable technological, social, and economic changes and their probable effects on lead demand during the forecast period. To establish demand in 2000, selected economic indicators were applied to 1973 consumption date. Using the forecast base in 2000 as a starting point, contingency assumptions that would significantly increase or decrease the forecast base were considered for each of the major end uses of lead during 1973-2000.

Assumptions for rest-of-world growth are similar to those for the United States, but demand for lead between 1973 and 2000 is expected to grow at a faster rate in the developing nations than in the United States. The future demand in other industrialized countries is assumed to parallel that developed for the United States.

LEAD CONSUMPTION FORECASTS - GROWTH RATES PER ANNUM : TABLE 24.3.1.

		EEC	USA	Japan	Other Western World	Western World	World
U.S. Bureau of Mines							
primary lead	1973-2000		1.4				2.3
secondary lead	1973-2000		1.9				3.2
total	1973-2000		1.6				2.6
Stanford Research Institute							
refined lead	1973-1990	(1) 2.5	2.6	5.9	3.9	3.3	3.9
total lead	1973-1990	(2) 2.1	2.2	3.3			
'Lead and Zinc into the 80's'							
refined lead	1975-1985						2-2.5
U.S. Dept. of Commerce							
total lead	1976-1985		3.0				

(1) Excluding Ireland and Denmark
(2) Germany F.R., France, United Kingdom, and Italy

SUMMARY OF FORECASTS OF US AND REST-OF-WORLD LEAD DEMAND, 1973-2000 : TABLE 24.3.2.

Thousand short tons

	1973	2000 Forecast range		Probable		Probable average annual growth-rate 1973-2000, percent
		Low	High	1985	2000	
United States						
Primary (1)	1,059	1,150	2,290	1,200	1,530	1.4
Secondary	539	630	1,230	800	900	1.9
Total	1,598	1,780	3,520	2,000	2,430	1.6
Cumulative (primary)	- - -	29,800	43,700	13,600	34,900	- - -
Rest of world						
Primary (1)	3,021	5,380	6,230	3,960	6,040	2.6
Secondary	1,211	2,160	3,250	1,980	3,180	3.6
Total	4,232	7,540	9,480	5,940	9,220	2.9
Cumulative (primary)	- - -	112,200	121,000	43,000	119,200	- - -
World						
Primary (1)	4,080	6,530	8,520	5,160	7,570	2.3
Secondary	1,750	2,790	4,480	2,780	4,080	3.2
Total	5,830	9,320	13.000	7,940	11,650	2.6
Cumulative (primary)	- - -	142,000	164,700	56,600	154,100	- - -

(1) Industrial demand minus secondary

24.31.B - Stanford Research Institute : World Minerals Availability, 1975-2000 - Lead, April 1976

Demand projections were based on end-use analyses, historical relationships, and GNP and population relationships.
End-use analyses considered the growth of vehicle registrations and the use of lead in the most important sectors.
Demand projections were developed for total lead consumption of Japan, U.S.A. and the main EEC countries (table 24.3.3) :

TOTAL CONSUMPTION OF LEAD - '000 TONS

	1973	1985	1990	2000	growth p.a. 1973-1990
USA					
Batteries	698.1	942	1,135	1,648	+ 2.9%
Alkyl-lead	249.0	261	314	451	+ 1.4%
Cable	39.0	39	44	53	+ 0.7%
Sheet and pipe	40.5	73	93	155	+ 5.0%
Other	371.9	403	434	509	+ 0.9%
Total	1,398.5	1,718	2,020	2,816	+ 2.2%
JAPAN					
Batteries	144.9	186	221	313	+ 2.5%
Cable	28.7	34	37	46	+ 1.5%
Sheet and pipe	43.5	35	35	35	- 1.3%
Other	115.9	203	234	555	+ 4.2%
Total	333.0	458	574	949	+ 3.3%
EEC (1)					
Batteries	397.4	622	749	1,103	+ 3.8%
Alkyl-lead	79.7	114	136	194	+ 3.2%
Cable	175.3	197	218	265	+ 1.3%
Semis	195.5	229	253	314	+ 1.5%
Other	346.4	339	353	384	+ 0.1%
Total	1,194.3	1,501	1,709	2,260	+ 2.1%

(1) Germany F.R., France, United Kingdom and Italy

The results of projections indicate that lead consumption in battery applications will continue to be the fastest growing demand sector. The use of tetraethyl lead in gasoline will continue to be an important market sector for lead. Japan uses significant quantities of leaded gasoline, but all anti-knock additives are imported.

Projections of refined lead consumption were also made using the intensity of use (table 24.3.4) :

REFINED LEAD CONSUMPTION - '000 TONS

	1973	1985	1990	2000	growth p.a. 1973-1990
EEC (1)	1,072.6	1,426.6	1,630.6	2,179.8	+ 2.5%
USA	947.0	1,288.0	1,461.0	1,904.0	+ 2.6%
Japan	251.9	505.8	663.3	1,142.0	+ 5.9%
Other Western World	847.9	1,342.9	1,626.2	2,425.0	+ 3.9%
WESTERN WORLD	3,119.4	4,563.3	5,381.1	7,650.8	+ 3.3%
Eastern World	1,094.6	2,127.1	2,720.0	4,455.0	+ 5.5%
T O T A L	4,214.0	6,690.4	8,101.1	12,105.8	+ 3.9%

(1) Excluding Ireland and Denmark

In general, the long-term outlook for lead demand is viewed as relatively stable, in spite of short term variations.

Overly optimistic projections or their counterparts should be tempered by two important considerations. The first concerns the role of the developing nations that are not subject to the same environmental, financial, and political forces as the traditional lead-consuming countries. The increasing importance of this sector should help mitigate drastic changes in overall lead demand.

The second consideration refers to the natural inertia of a mature market such as that of lead. Most of the significant applications of lead are old and have been resisting substitution for many years. Thus the use of lead in batteries has influenced the rapid growth of the secondary lead industry. Drastic substitution of this end use is not likely for several reasons. The number of vehicles that are specifically designed to use lead batteries is large, consumer acceptance factors are strong, and an important market sector in the less developed countries may be unwilling to invest in new technology.

24.31.C - Conference "Lead and Zinc into the 80's" - June 1977

In the session "Lead, new trends for the 80's", Mr. Craig of St. Joe Minerals said that, for the decade after 1975, world lead consumption should grow at the rate of 2 %-2.5 % per year, raising the level from 3.8 Mt to 4.85 Mt.

The strongest field will be battery demand, though the trend towards lighter batteries will slow this growth. Most of the growth in lead usage will occur in Japan and in the developing countries, with the U.S.A. and Europe hanging back.

24.31.D - U.S. Dept. of Commerce : U.S. Industrial Outlook 1977

Lead consumption is expected to grow at 3 % per year for 1976 to 1985, to a level of 1.8 Mt despite the reduced market for anti-knock compounds. This growth will be through the greater use of lead in batteries.

The use of battery-powered vehicles is expected to increase as they become more efficient and gain wider acceptance.

There is potential growth in electric utility "load-levelling" applications, using batteries to supply large amounts of energy for use during peak periods, maximizing the efficiency of conventional electric generating operations.

Increasing demand for maintenance-free batteries is also seen.

24.32 - <u>Outlook for refined lead consumption</u> (table 24.3.5)

Forecasts concern the long period up to 1990. 1972 was taken as the base year, being the last "normal" year available.
Forecasts for the EEC (Section 24.4), were based on total consumption by uses, and consumption of refined lead was then calculated. Forecasts for the other economic areas (U.S.A., Japan, other Western world developed countries, and developing countries) were made through an analysis of data available in the literature.

In general, demand for lead is more stable compared with that for other non-ferrous metals, and more significant developments should occur in Japan and the developing countries, while more limited increases are anticipated in the U.S.A. and Europe.

In particular, as far as the developing countries are concerned, there are several factors which will influence the rate of growth in consumption. First the impact of the higher cost of energy, and particularly of oil, will prove a burden to most of the developing countries, although the extra income will stimulate the economies of oil producers such as those in the Middle East and Venezuela.
In the Middle East industrialization is accelerating but populations are small and standards of education comparatively low. In all the other areas continued expansion of consumption can be expected, with new industries being established within the countries themselves, while the industrialized countries will go on supplying many manufactured goods.

Stability in the development of lead is due mainly to the steady expansion in the battery industry, where, for at least the next 10-15 years, no replacement of lead by alternative materials is expected.
As far as batteries are concerned, however, a decrease in the growth rate may be foreseen in connection with their higher average life cycle, until a new equilibrium is reached.

On the basis of the conclusions drawn from the American surveys, for the U.S.A. the growth rate from 1972 to 1990 could oscillate between 1.5 % and 2 %.

As for Japan, considering the general consensus that the demand for lead will continue to increase notably more than in other main industrialized areas, and taking into account the Stanford's forecasts on consumption by uses, a 3 %-3.5 % average growth rate can be assumed from 1972 to 1990.

The developed countries of the Western world, other than the EEC, U.S.A., and Japan, considering that for some of them a real industrialization is still to be accomplished, should register on the whole a more noticeable development compared with that of the EEC and U.S.A., but lower than that forecast for Japan. For this group of countries a growth rate varying between 2 % and 3 % can be assumed.

As to the developing countries, in consideration of what previously stated, growth rates equal to those registered in the past can be assumed, that is between 4 % and 4.5 %.

REFINED LEAD CONSUMPTION - '000 TONS (table 24.3.5)

	1972	1976	1985	1990
EEC	1,050.7	1,029.2	1,150	1,200
USA	1,009.6	936.6	1,200-1,300	1,300-1,400
Japan	231.0	229.8	340-360	390-430
Other developed countries	435.3	474.9	560-640	620-740
Developing countries	334.1	379.8	560-590	680-740
WESTERN WORLD	3,060.7	3,050.3	3,810-4,040	4,190-4,510

On the basis of forecasts formulated for the various economic areas, the growth rate of consumption in the Western world over the period 1972 to 1990 will lie between 1.8 % and 2.2 %. The growth rate for the EEC during the same period of time will be lower than 1 %.

24.33 - Present uses

Present uses of lead and their effect on lead consumption have been detailed in Part 2.2 "Structure of consumption". Forecasts at world and EEC levels show the effects of market trends of present uses, both in the base cases and in the contingencies. In fact only some uses, especially the lead acid batteries, maintain their position on the market, with growth rates connected to the economic activity and the introduction of the "maintenance-free" and low maintenance batteries.
Unchanged, though limited to certain markets, is the position in ceramics and shots.
Lead consumption for the production of alkyl-lead compounds is bound to decrease because of the reduction of their content in petrol.

Special duties services continue to rely on lead for cable sheathing, but plastic coverings have supplanted lead in recent years in less critical services. Consumption of lead in roofing, piping and caulking has declined. Conflicting trends, generally oriented downwards, are registered in the traditional uses of alloys.

Fundamental changes are taking place in printing techniques which, in time, will have a significant negative effect on the demand for printing metal and, of course, for lead.

There are technical, economic and social reasons for this major change in technology.

24.34 - New uses

They include mainly the possibilities of development for already known uses :

- Growing use of lead as a sound barrier in partitions and ceilings of offices, schools and hotel buildings;
- Lead plates as vibration damping pads;
- Lead composites : composites often possess final characteristics which are better than the total of the properties of the individual materials used to make up the composite. As an example, a lead plastic foam composite possesses both sound isolation and sound absorption properties.

Since lead shows good melting and fusion properties, in the past most of the lead composites were used with metallic bonding. However, a great number of new lead composites have come into being as a result of modern technological advances and through the use of organic adhesives. These modern combinations of materials will play an important role in the future of lead.

Lead composites with metallic bonding possess a higher temperature resistance and good thermal and electrical conductivity. The strength of the metallic bond is as strong as the strength of lead and such composites are thus capable of being used under difficult conditions. This group of materials includes terne plate as well as lead-clad sheet for architectural purposes and for chemical and other equipment.

Lead composites can also be adhesively bonded with non-metallic materials, thereby increasing the use of lead. The technology of organic adhesive bonding is developing rapidly and markets for these composites seem to be good.

Resistance of the organic adhesive bond to elevated temperatures is limited. These composites would therefore be considered for the following purposes :

- architecture
- radiation shielding and sound insulation
- the packaging industry
- chemical apparatus and installations, for temperatures below about 80°-100° C.

This group includes :

- Lead bonded to wood or plastic for radiation shielding, sound insulation and external cladding.
- Plastic or paper-covered lead sheet for the packaging and building industries.
- Composites of plastic foam and lead for sound insulation.
- Lead alloys as a current carrying member in superconductivity cables operating at the temperature of liquid helium : application in moderate magnetic fields and D.C. power transmission system;

ternary and quaternary alloys : markets lead acid battery and chemical processing equipment.

- Electric vehicles.

  Electric vehicles may play an appreciable role in reducing transportation's use of gasoline for propulsion. In order to gain acceptance by the consumer public for electric vehicles, the present state-of-the-art must be greatly improved and there must be a concerted effort to put the new cars in service so that people can drive and evaluate them.

  The program mandated in the United States by the Electric and Hybrid Vehicle Research, Development and Demonstration Act is designed to do this. It is a six-year program for a total expenditure of $ 160 million. Over a six-year period the Energy Research and Development Administration (ERDA) will conduct a three-phase program for the establishment of basic performance criteria on which to base the designing of 2 500 cars for the testing in the second-phase. The third-phase will establish the revised performance standard based upon the advanced technology resulting from the ongoing research during the first four years. 5 000 additional cars will then be purchased on the most advanced state-of-the-art.

  The statistics of American driving patterns substantiate the usefulness of these cars as "second cars". More than half of the total automobile driving in America consists of trips of 5 miles or less, driving conditions under which internal combustion engines operate least efficiently. Thirty seven percent of the total U.S. public would purchase an electric car with these characteristics : for travelling around town, shopping and possibly commuting; having a top speed of 50 miles per hour and a range of about 40 miles before recharging; having costs equal to or less than a gasoline-powered subcompact; and be small, easy to park and sell for from $ 3 000 to $ 5 000.

  In the final analysis electric cars can have a far-reaching effect on the American scene. Because their power supply will be derived from coal and nuclear, they will reduce oil consumption. They will alleviate both air and noise pollution by their clean, quiet operation and they will help to balance utility loads by off-peak hour battery charges.

They will make a unique contribution by simultaneously forwarding U.S. economic, conservation, environmental and national security goals.

General Electric Company agrees that a penetration by electrics of 7 % of the total vehicle market by the year 2 000 is "reasonable".

Most Electric Vehicle experts agree that no battery system will become available in the next 10 years which can compete with lead-acid on the basis of cost performance and reliability. ERDA is sponsoring the development of both a near term improved state-of-the-art, and a longer term advanced lead-acid Electric Vehicle battery. ERDA's performance goals appear to be achievable, say battery makers, and the lead-acid industry is heavily involved in the R & D.
R & D activity is developed for other battery technologies : lithium - metal sulphide, sodium - sulphur, zinc - chlorine, nickel - zinc.

24.4 - LEAD : TOTAL METAL CONSUMPTION IN THE EEC (INCLUDING METAL FROM SCRAP), BY USES

Demand of lead for batteries, alloys, chemicals other than alkyl-lead, and miscellaneous uses (indicated as "Unspecified"), has been projected by means of a forecast base by relating demand to the most appropriate economic indicator selected from GNP and population. Each forecast base was examined and, if necessary, modified by contingency assumptions and other factors based largely on knowledge and judgement of engineering trends and utilizations.
Demand is expressed in lead total consumption. Forecasts on the portion furnished by scrap have been reported in Section 21.24.

Economic indicators

As to GNP, a growth rate of 3.5 % per annum was considered for the period 1972-1980, and of 4 % for the following decade. As to population, a growth rate was considered along the line of the one registered in the most recent years, equal to 0.6 % per annum.

Lead shots

We did not deem necessary to correlate the consumption of lead for shots production to the growth rate of population, because of the different structure of the market in the various countries.
Therefore, for Italy was applied the growth rate forecast by producers of shots and cartridges, estimated to be 4 % per annum up to 1985, and 3 % during the following five-year period, having taken into account the increasing interest for clay-pigeon shooting, and exports, which account for about 25 % of domectic production; for France, we followed the indications derived from the document received from our "co-pilot" of this study : for the U.K., the growth rate was maintained constant. For the other EEC member countries, as no data are given regarding this item, a possible consumption of lead for shots production has been assumed under "semifinished products" or "unspecified" items. As a whole therefore, a consumption of 80 000 tons in 1985 and 95 000 tons in 1990 is foreseen.

Other semis

The negative trend of the sector prevails in this case, due to the intensity with which lead has been replaced by other materials in traditional uses, so that a correlation using economic indicators would be meaningless. From 1965 to 1975 the growth rate in the Community area was-2.7 %, although with situations varying from one country to another, very near to the -2.5 % registered on the whole in the U.S.A., Japan and EEC in the period 1963 to 1973. Possibilities for an increase may be ascribed to the sector of lead pads and lead sheets for vibration dampening and noise abatement.
Consumption forecast is 135 000 tons for 1985 and 120 000 tons for 1990.

Cable sheathing

After examining the literature available and taking into account the opinions of the sector operators, we derive the conclusion that substitution of lead in this field is an irreversible process.
In the last decade, average growth rate in the Community area, Italy excepted, was -10 %. The Italian situation is different as, according to SIP and ENEL's views (both State-owned companies, the former for telecommunications, and the latter for electric energy), current consumption is determined by the necessity to make more adequate the telephone and the electric networks, and no substitution for cable lead sheathing is anticipated during the next 10-15 years.

The Italian consumption of lead for cable sheathing will be estimated on the basis of the present amounts (approx. 50 000 tons); assuming as constant also that share of production destined to export. Thus EEC's consumption will account for 100 000 tons in 1985 and 80 000 tons in 1990.

Anti-knock compounds

Current consumption of lead for the production of TEL and TML is connected with the Italian, French, and English plants capacity for these compounds. The product is placed also outside the Community area, in conformity with specific commercial agreements.

The reduction of anti-knock compounds in petrol down to 0.15 g/l from the previous 0.4 g/l, in compliance with the EEC Directive and following the example of Germany, does not necessarily imply a decrease in lead consumption because of a general rise in petrol consumption, as well as for commercial reasons.
Therefore a lead consumption of 80 000 tons was assumed for both 1985 and 1990.

Batteries

Lead consumption for batteries has been calculated by correlation with the GNP as to SLI and traction batteries, and with the population as to stationary batteries. The consumption thus derived regarding SLI batteries is equal to that which can be obtained by assuming a 3 % yearly increase in vehicle registrations, and accepting the average current life cycle established for batteries. The result was : 660 000 tons for 1985 and 770 000 tons for 1990.
On the other hand, the possible consequences arising from a gradual substitution by LM - Low Antimony without regenerator and MF - Pb-Ca batteries have been considered. In Europe, Sb content in grills is already being lowered, and in 1985 this is expected to be down to 2.3 %-2.5 %. This lower percentage of antimony, though not providing the battery with the characteristics of a MF battery, offers however the advantage of a longer lasting life and of a reduced capacity of self-discharging, thus enabling storage for longer periods.
From 1985 onwards, it may be supposed that MF batteries of both the Pb-Ca type and the Pb-Sb type with catalytic regenerator will be entering the market. The introduction rate may be of 10 %-20 %. The consequences of this substitution are not yet evident in 1985, while the period around 1990 is considered as very critical in this respect.
After 1990 a new equilibrium will be noticed and consumption will start to rise again according mainly to the production of the automotive industry.

In the light of the above considerations, consumption in 1990 would amount to 530 000 tons, that is 240 000 tons less compared with the figure previously given.

With regard to the opportunity for the electric vehicle, of the two hypotheses : (i) replacement in Europe of 20 % of the market for the second car; and (ii) the main market will continue to be in the established industrial truck market and other areas where emissions are unacceptable, and the new market will be for postal delivery and, possibly, bus system; we deem the second one to be more realistic. In this case we estimate that EEC's consumption in this field could amount to 100 000 tons in 1990.

On the other hand, the significant competition from other types of batteries after 1985, for the electric vehicle as well as other uses, could nullify the increase indicated as a consequence of the development of the electric vehicle. In our assessments, replacement of the lead-acid batteries for SLI application is not considered feasible.

Finally, we deem that lead consumption for batteries will be 660 000 tons in 1985 and 650 000 tons in 1990, allowing for a slower introduction of the LM and MF batteries.

Other chemicals

By "other chemicals" are meant lead oxides for ceramics, paints and glass. Consumption has been related to population. The figure obtained has been modified to take into account forecasts on growth formulated for France. Lead consumption in this field covers the second place in order of importance, and it is connected to the remarkable developments registered in the ceramics market in Italy and France. A consumption of 350 000 tons is forecast for 1985, and 450 000 tons for 1990.

Alloys

We adopted a correlation with population, the result of which was 65 000 tons for 1985 and 70 000 tons for 1990.

Total consumption

The following table shows the final data for 1972 and 1976 and forecasts for consumption by 1985 and 1990 (table 24.4.1).

In terms of percent, a 1.6 % increase is shown for the period 1972 to 1985, and 1.5 % for 1972 to 1990. In some cases are also given the projections (base case) for 1985 and 1990.

TABLE 24.4.1.

'000 tons

	1972	1976	1985 base case	1985 forecast	1990 base case	1990 forecast
Semis and shots	236.0	238.4		215		215
Cable sheathing	228.4	172.5		100		80
Batteries	385.2	429.7	660	660	770	650
Alloys	61.8	50.2	65	65	70	70
Anti-knock	77.7	80.6		80		80
Other chemicals	189.5	232.0	330	350	400	450
Unspecified	113.5	104.9	130	130	145	145
Total	1,301.1	1,308.3		1,600		1,690

24.5 ZINC : METAL CONSUMPTION

24.51 Review of the zinc forecasts available in the literature (table 24.5.1)

24.51.A - U.S. Bureau of Mines : Mineral Facts and Problems, 1975 edition (table 24.5.2)

U.S. demand for zinc in 2000 is forecast to be between 2.15 and 4.56 million short tons with a probable demand of 3.2 million tons representing an annual growth rate of 2.5 %. These forecasts are summations of separate forecasts for industrial enduses.
Possibilities supporting the high forecast are large increases in growth rate for present uses of zinc, such as galvanizing in the construction industry or galvanizing sheet steel used in automobiles, as well as the development of new uses. Expansion in the use of die castings and brass products resulting from technological improvements and increased requirements in new machinery and equipment could also lead to a high demand in 2000. Substitution for zinc and its subsequent elimination from major industrial fields and lower automobile production would result in the low demand forecast.

For the rest of the world, a probable demand of 10.1 million tons is forecast for 2000. The range of demand in 2000 is projected to be between 7.2 million and 12.0 million tons.

24.51.B - Stanford Research Institute : World Minerals Availability, 1975-2000 - Zinc, April 1976

The method adopted for forecasts is based on the relationship between steel production and zinc consumption per country.
The historical relationship between steel production and consumption of zinc for the two most important applications (galvanizing and die casting) is excellent.
The projections of steel production utilized and of slab zinc consumption are reported in tables 24.5.3 and 24.5.4.

ZINC CONSUMPTION FORECASTS - GROWTH RATES PER ANNUM : TABLE 24.5.1.

		EEC	USA	Japan	Other Western World	Western World	World
U.S. Bureau of Mines							
primary zinc	1973-2000		2.5				2.3
secondary zinc	1973-2000		2.0				1.4
total	1973-2000		2.5				2.2
Stanford Research Institute							
slab zinc	1973-1990	(1) 1.6	1.7	2.0	5.3	2.8	3.1
'Lead and Zinc into the 80's'							
slab zinc	1975-1985						3.0
U.S. Dept. of Commerce							
slab zinc	1976-1985		3.0-4.0				

(1) Excluding Ireland, Denmark, and Netherlands

SUMMARY OF FORECASTS OF U.S. AND REST-OF-WORLD ZINC DEMAND, 1973-2000 : TABLE 24.5.2.

Thousand short tons

	1973	2000 Forecast range Low	2000 Forecast range High	Probable 1985	Probable 2000	Probable average annual growth rate 1973-2000, percent
United States						
Metal:						
Primary (1)	1,316	1,800	3,700	1,800	2,600	2.6
Secondary	89	100	200	110	150	2.0
Nonmetal: Primary	244	250	660	320	450	2.3
Total United States:						
Primary (2)	1,560	2,050	4,360	2,120	3,050	2.5
Secondary	89	100	200	110	150	2.0
Total	1,649	2,150	4,560	2,230	3,200	2.5
Cumulative (primary)	---	48,600	75,200	22,200	60,600	---
Rest of world:						
Metal:						
Primary (1)	4,700	6,000	9,000	6,000	8,000	2.0
Secondary	570	500	1,000	670	800	1.3
Nonmetal: Primary	450	700	2,000	720	1,300	4.0
Total rest of world:						
Primary (2)	5,150	6,700	11,000	6,720	9,300	2.2
Secondary	570	500	1,000	670	800	1.3
Total	5,720	7,200	12,000	7,390	10,100	2.1
Cumulative (primary)	---	160,300	212,600	71,400	191,300	---
World:						
Metal:						
Primary (1)	6,016	7,800	12,700	7,800	10,600	2.1
Secondary	659	600	1,200	780	950	1.4
Nonmetal: Primary	694	950	2,660	1,040	1,750	3.5
World total:						
Primary (2)	6,710	8,750	15,360	8,840	12,350	2.3
Secondary	659	600	1,200	780	950	1.4
Total	7,369	9,350	16,560	9,620	13,300	2.2
Cumulative (primary)	---	208,900	287,800	93,600	251,900	---

(1) Metal demand less old scrap
(2) Industrial demand less old scrap

WORLD RAW STEEL PRODUCTION - '000 M.TONS : TABLE 24.5.3.

	1973	1985	1990	2000
Western Europe				
Belgium/Lux.	21.5	25.5	27.2	33.0
Denmark	0.5	1.0	1.3	2.0
France	25.3	36.0	42.0	56.0
Germany, West	49.5	59.0	66.7	81.0
Italy	21.0	35.7	41.5	54.0
Netherlands	5.6	7.8	8.8	12.0
Norway	1.0	1.2	1.3	2.0
Portugal	0.5	2.4	2.7	4.0
Spain	10.7	23.0	26.5	45.0
Sweden	5.6	9.5	12.0	18.0
Switzerland	0.6	0.7	0.8	1.0
United Kingdom	26.6	35.5	39.7	50.0
All other	10.8	18.0	22.0	35.0
Subtotal	179.2	255.3	292.5	393.0
Eastern Europe	46.8	85.1	98.7	122.2
USSR	131.3	179.6	207.3	283.5
North America				
Canada	13.8	24.0	37.0	67.0
United States	136.4	164.0	184.0	230.0
Subtotal	150.2	188.0	221.0	297.0
Latin America				
Brazil	7.2	33.0	50.0	100.0
Mexico	4.7	14.0	20.0	40.0
All other	4.5	12.0	16.0	32.0
Subtotal	16.4	59.0	86.0	172.0
Africa and Middle East				
South Africa	5.7	14.0	20.0	34.0
All other	1.5	7.0	10.0	26.0
Subtotal	7.2	21.0	30.0	60.0
Asia and Far East				
Australia	7.5	16.0	25.0	50.0
China, People's Republic	25.3	67.9	92.6	166.4
India	6.9	13.3	16.3	23.7
Japan	119.3	161.0	185.0	225.0
All other	6.4	15.1	28.6	90.2
Subtotal	165.4	273.3	347.5	555.3
World total	696.5	1,061.3	1,283.0	1,883.0

TABLE 24.5.4.

PROJECTED CONSUMPTION OF SLAB ZINC BY COUNTRY - '000 M.TONS

	1973	1985	1990	2000	Growth p.a. 1973-1990
Western Europe					
Germany, West	438	525	594	722	
United Kingdom	302	341	366	424	
France	290	323	363	449	
Italy	220	334	385	492	
Belgium/Lux.	180	172	179	200	
Others (1)	250	335	366	479	
Subtotal	1,680	2,030	2,253	2,766	+ 1.7
North America					
United States	1,363	1,615	1,820	2,294	+ 1.7
Canada	153	187	260	409	
Subtotal	1,516	1,802	2,080	2,703	
Japan	774	965	1,079	1,262	+ 2.0
Other countries (2)	812	1,713	2,280	3,279	
Western world	4,782	6,510	7,692	10,010	+ 2.8
USSR and Eastern Europe					
USSR	600	829	947	1,236	
China, People's R.	190	423	541	859	
Eastern Europe	392	708	869	1,304	
Subtotal	1,182	1,960	2,357	3,399	
World total	5,964	8,470	10,049	13,409	+ 3.1

(1) Includes Denmark, Netherlands, Norway, Sweden, Spain, and Switzerland.

(2) Rest of the free world, less North America and Western Europe as defined above.

Most of the demand for zinc will be absorbed by the steel galvanizing and the die-castings industries, which will continue to be the two most important market sectors for zinc. Galvanizing is likely to experience sustained growth in most countries regardless of their level of economic development, while die casting may face increasing substitution from plastics and aluminium in the highly industrialized nations.

24.51.C - Conference "Lead and Zinc into the 80's", June 1977

In the session "Zinc - will the 80's bring new trends ?", Mr. Hendrick of Noranda and current ZDA/LDA chairman said that his first assumption is that the major nations will harmonise their policies and resume sustainable, real economic growth, without excessive inflation. This is not as unrealistic as the pessimists may believe. In the past, zinc consumption worldwide has grown at a compound annual rate of 4 %, including Japan's remarkable 10 % or more. Mr. Hendrick suggests 3 % is more likely in the future.

24.51.D - U.S. Dept. of Commerce : U.S. Industrial outlook 1977

U.S. zinc consumption is expected to grow at an annual rate of approximately 3 %-4 % in the period 1976-1985, bringing 1985 usage to 1.75 million short tons. The major markets are expected to remain relatively stable in the short term, but some shifts are likely by 1985, notably probable technological changes in die-castings and galvanizing applications.

In 1971 the motor industry used about 60 lb of die-cast zinc per car; this fell to about 45 lb in 1976. This trend could be reversed in future by the advent of "thin-wall" die-casting using less zinc per part and which could eventually benefit zinc by increasing its competitiveness with other materials. Another major market change seems likely in increasing use of galvanized steel by the motor and construction industry.

24.52 - Outlook for slab zinc consumption

Forecasts concern the long period up to 1990. 1972 was taken as the base year, being the last "normal" year available. Forecasts for the EEC (Section 24.6) were based on total consumption by uses, and consumption of slab zinc was then calculated. Forecasts for the other economic areas (U.S.A., Japan, other Western world developed countries, and developing countries) were made by an analysis of data available in the literature.

The analysis of zinc demand indicates that the building and construction industry and the transportation industry will continue to be the most important market sectors for zinc. Thus, galvanizing and diecasting should remain the most significant application of zinc, accounting for more than 50 % of total world consumption.

Long term demand for slab zinc is expected to grow at a lower rate than that registered in the past and the industrialized countries are expected to exhibit a lower growth in zinc demand than the less developed nations.

Regarding the United States, taking into account results from the American surveys, the growth rate in the period 1972 to 1985 could vary between 2 % and 2.5 %.

As to Japan, 2.5 %-3 % growth rates were assumed (very limited compared with the past), considering above all the fact that the Japanese economy will necessarily tend towards rates characteristic of more mature countries, though being uncertain how and when this will occur.

As to the Western world developed countries other than the EEC, U.S.A. and Japan, a growth rate of 2 %-2.5 % was considered.

As far as the developing countries are concerned, in view of the considerations stated in the section on Lead regarding their possible economic development, growth rates of 4 %-5 % were assumed.

SLAB ZINC CONSUMPTION - '000 TONS (table 24.5.5)

	1972	1976	1985	1990
EEC	1 352.6	1 207.4	1 620	1 820
Japan	716.7	698.6	990-1 050	1 120-1 220
U.S.A.	1 285.7	1 022.5	1 660-1 770	1 840-2 000
Other developed countries	548.9	586.5	710- 770	770- 860
Developing countries	544.6	629.8	900-1 020	1 100-1 300
WESTERN WORLD	4 448.5	4 144.8	5 880-6 230	6 650-7 200

On the basis of forecasts formulated for the various economic areas, the growth rate of consumption in the Western world over the period 1972 to 1990 lies between 2.3 % and 2.7 %. In consideration of the difficulties which may condition the world economy and the impact of alternative products, a lower growth rate is deemed more probable. In the same period of time the growth rate for the EEC lies between 1.5 % and 2 %.

24.53 - New uses

Current uses and alternative products of zinc have been described in chapter 2.2 on "Structure of Consumption".
In this section we will therefore limit ourselves to the new uses, which have been taken into account for the forecasts on consumption. We deem useful to refer to, in general lines, the Research programs of the International Lead and Zinc Research Organization Inc. extracted from the Research Digest 1976.

- Zinc alloy die casting

The objective of the research is to improve the thin-wall technology, from a technical and economical point of view, so that to make it more competitive in comparison with other materials and manufacturing methods.

- Zinc alloys

Research concerning relationships between the microstructure and mechanical properties of alloys; hand-book providing indications to devise die cast and gravity cast alloy parts.

- Surface treatment

Objectives : to reduce production costs and improve at the same time the quality of die castings; to finalize new coating systems and increase the knowledge regarding the zinc-rich paints sector.

- Promotion of lead and zinc uses in multiple architectural applications.

- Hot-dip galvanizing

Intensification of research studies concerning galvanizing of structural silicon killed steels.

- To fight corrosion. Objectives :

. defining the factors necessary for a rational production of pre-painted continuous galvanized strips characterized by a good suitability for paint adherence;

. improved corrosion resistance performance offered by bolted galvanized joints;

. research in galvanized reinforced bars;

. research of new coatings on galvanized steel for hot and cold water pipes.

- Chemical products

Comprehensive research on zinc oxide as stabilizer in plastics and ceramics. ZnO provides outstanding stabilization against ultraviolet degradation in outdoor plastics.

- Zinc batteries

Research on improvement of alloys from the point of view of their resistance to corrosion during storage time.

In the field of application, major innovations concern :

- a wider use of zinc coated steel sheets by means of hot-dip galvanizing on both or just one side through the application of Zincrometal with the objective of providing the more exposed parts of a vehicle with a higher protection, and prolonging the guarantee period;

- application of Zn-Al alloys in steel sheet galvanizing;

- zinc oxide in outdoor plastics;

- application of superplastic alloys of zinc and aluminium as substitutes for sheet steel applications because of their malleability at certain heats and high strength at room temperature;

- extension into more uses of thin-wall die casting technology.

24.6 - TOTAL METAL CONSUMPTION IN THE EEC, BY USES (INCLUDING METAL FROM SCRAP)

Demand, expressed as zinc total consumption, for each of the major uses has been projected by means of a forecast base obtained by relating demand to the most appropriate economic indicator selected from GNP, population and steel consumption. The forecast base was modified by contingency assumptions and other factors based largely on knowledge and judgment of engineering trends of utilization.

Economic indicators

As to GNP, a growth rate of 3.5 % per annum was considered for the period 1972-1980 and of 4.0 % for the following decade. As to population, a growth rate was considered along the line of the one registered in the most recent years, equal to 0.6 % per annum. As to steel consumption, from indications derived from the literature, a 3.6 % annual growth rate was considered until 1990.

Galvanizing

Correlation with steel consumption has been applied, which gave the following result : 760 000 tons and 870 000 tons for 1985 and 1990, respectively. Some factors which could affect such zinc consumption have then been considered : they refer mainly to steel sheet galvanizing. There appears an obvious tendency on the part of the car manufacturers to be oriented towards a guarantee of a global type. Whence the necessity for better protection of the car body or parts of it more severely subject to corrosion. Following the American and Swedish examples, a tendency can be assumed for an ever wider use of galvanized sheet in motor-vehicles, be it the traditional one, the one-side galvanizing, or the Zincrometal system. Another sector which shows signs of rapid expansion is that of the galvanized sheet in building : what happens in Australia is an example. Negative factors to be considered are :

(i) the tendency to reduce the thickness of zinc coating applied on the sheet which, though not affecting the good performance provided for corrosion resistance (as the galvanized sheet is usually overpainted), has however the effect of reducing the consumption of zinc per unit of galvanized steel;

(ii) the possible gaining ground of processes alternative to galvanizing such as the Galvalume for instance.

Another positive factor may be the tendency in France to develop general galvanizing, the use of which is currently not so widespread in that country as it is in others.

Finally, the probable consumption of zinc in galvanizing is anticipated to be 840 000 tons in 1985 and 940 000 tons in 1990.

Die casting alloys

Through the breakdown of die casting uses given in Section 2.1, which derives from studies conducted by Istituto Italiano Piombo e Zinco and Zinc Development Association, the quota relating to consumption by motor-vehicle has been estimated on the basis of forecasts for motor-vehicles production; the remaining part has been related to the population.

Forecasts for consumption thus obtained give 335 000 tons for 1985, and 390 000 tons for 1990. We then considered the effect caused by the impact of thin wall technology which, on one hand tends to maintain a share of the market for zinc, where lighter materials such as plastics and aluminium are highly competitive, and on the other hand, owing to its intrinsic technology, tends to reduce the weight of the manufactured piece.

Not all sectors will be affected by the thin wall technology; this technology is deemed to be applicable in the automotive, commercial and office equipment, as well as the sound and TV sectors for a total of about 50 % of consumption. Weight reduction should be around 10 %.

Based on what stated above, zinc consumption for die castings is therefore estimated to be 320 000 tons in 1985 and 370 000 tons in 1990.

Semifinished products

Regarding semifinished products, there are no indications that the result obtained by relating the consumption for these products to the population should have to be modified.

Consumption figures anticipated for 1985 and 1990 are 170 000 tons and 160 000 tons, respectively; thus continuing the downward trend registered in the past years.

Oxides

Consumption of zinc metal for the production of oxides has been partly related to the GNP (tyres) and partly to the population (stabilizers, pigments, etc ...). From such correlations derives a base case of 165 000 tons and 180 000 tons by 1985 and 1990, respectively. In addition, possible development of zinc oxide application should be considered in outdoor plastics for ultraviolet rays screening.
Therefore, zinc consumption for oxide production is assumed to be 185 000 tons by 1985 and 210 000 tons by 1990.

Brass

From the C.E.C.-DG XII "Dossier on Copper," it appears that brass accounts for about 30 % of total consumption of copper, equal to 3 300-3 500 tons in 1985 and 3 600-3 900 tons in 1990.
The corresponding amounts regarding zinc are 550 000 tons in 1985 and 650 000 tons in 1990.

Total consumption

Final consumption figures for 1972 and 1976, and forecasts for 1985 and 1990 are shown in the following table.
The average annual growth rate for 1972-1990 concerning zinc total consumption is therefore 2.3 %.

TOTAL ZINC CONSUMPTION IN THE EEC - '000 TONS (table 24.6.1)

	1972	1976	1985	1990
Galvanizing	552.1	511.8	840	940
Brass	429.1	437.8	550	650
Die casting	257.2	242.1	320	370
Semis	201.4	198.4	170	160
Oxides	120.1	131.7	185	210
Unspecified	101.3	89.3	135	170
TOTAL	1 661.2	1 611.1	2 200	2 500

24.7 - DEGREE OF FOREIGN DEPENDENCE OF EEC COUNTRIES FOR RAW MATERIAL SUPPLY

The degree of foreign dependence of EEC countries for raw material supply is dependent on total metal consumption, on the domestic supply of concentrates and scrap as well as on the capacity of smelters and refineries.

The validity of forecasts for domestic scrap availability is conditioned by the implementation of a policy for the support of recycling, by the conduction of Research and Development programmes, by the construction of plants for zinc recovery from steelwork fumes, by a final solution of the problems connected with solid wastes, by the development of a technology for recovery of zinc oxide from tyres.

As concerns mining production, on the basis of known programmes, forecasts until 1985 may be easily formulated, while for the following period (until 1990) they depend on the entering into production of the ascertained reserves as well as on the results of research on the known deposits.

Mine production (metal content)

Ireland

New mines are expected to start production within 1985 for a total of 57 000 tons of lead ores and 280 000 tons of zinc ores.
With respect to the mining reserves presently exploited (Tynagh and Silvermines) it is possible to expect, within 1985, a production of 90 000 tons and 340 000 tons for lead and zinc ores respectively.

The extension of the same production level to the following period is linked to the entering into production of new mines in substitution of Tynagh and Silvermines.

France

Mining production up to 1985, calculated as 30 000 tons for lead ores and 40 000 tons for zinc ores, has been evaluated on the basis of the following mines :

Lead : Largentière, Malines, Les Farges

Zinc : Largentière, Malines, Saint-Salvy.

After 1985, depletion of the Largentière deposit must be taken into account (20 000 t/y of lead ores and 3 500 t/y of zinc ores); no elements are presently available to evaluate the contribution of the deposits now being explored in the Pyrenees and in Brittany.

Greenland

The ascertained reserves correspond to 5-6 years of production at the present rate.
As there are reasonable chances of extending the present reserves, production until 1985 and, as a first hypothesis, even until 1990, may be expected to be maintained on the same level (about 30 000 tons of lead ores and 80 000 tons of zinc ores).

Germany FR

As concerns Germany FR the document of the International Lead and Zinc study Group does not report new mine projects nor mine closures.
Moreover, we do not have direct or indirect data on the entity of the reserves.

Under these conditions the only possible forecast is to assume for 1985 a production corresponding to the present rate (about 40 000 tons of lead ores and 140 000 tons of zinc ores) while it is not possible to make forecasts for the following period.

Italy

On the basis of demonstrated reserves, assuming a production maintained on the present levels for the private sector and taking into account the implementation of programmes for the public and government-controlled sector, production for 1985 is expected to be 40 000 tons lead ores and 100 000 tons zinc ores.

With respect to the results attained by the research programmes of the government-controlled sector, as well as to the results of the multi-annual research and development programme in the field of primary raw materials (indirect action 1978-1981) in the EEC countries and, finally, in consideration of possible interventions, within the framework of the Community policy, on research for the valorization of deposits in the member countries, Italian production could undergo some changes towards the second half of the 1980's.

E E C

According to the above, total EEC production (including Greenland) for 1985 is expected to be of 230 000 tons lead ores and 700 000 tons zinc ores.

Residues from ore processing and primary metallurgy lead, zinc, pyrites

Presently, in Italy, such residues amount to 10-15 000 t/y zinc.
A research action has been included in the recommendations for R & D for the recovery of mining and metallurgical residues in Sardinia.
Should metal recovery from such residues be successful, the quantities of lead and zinc recoverable could notably increase with respect to the depletion rate of such residues.

Approximately, the new level could be equal to about 30 000 tons zinc. This problem could also interest other EEC countries for which no data are available.

Plant capacities

With respect to the present situation, the following increases of EEC plant capacities are expected :

- 20 000 tons for lead smelters in Italy
- 50 000 tons for lead refineries in Italy
- 50 000 tons for zinc smelters in Italy
- the document of the International Lead and Zinc Study Group reports, under the heading "other smelter projects known to be under consideration", a new zinc plant with a 100 000 tons capacity, in Ireland.

Overall lead smelter capacity in EEC would be 633 000 tons, while primary lead refinery capacity would be 816 000 tons.

It has been assessed that presently about 100 000 tons bullion, and consequently of primary refined metal, come from residues and scrap. No elements are available justifying a future variation of such a tonnage.

Zinc smelter capacity in EEC, on the basis of the above mentioned increases, would go up to 1.9 million tons.

Lead and zinc balance in EEC

Considering that the definition of refined lead will change as concerns in particular secondary refined metal and remelt, in estimating the EEC lead balance, the quota of primary and secondary metal has also been evidenced.

These kinds of problems do not exist as concerns zinc, whose balance has thus been made on the basis of the usual schema.
In particular, slab zinc consumption has been calculated with respect to the pattern of consumption and to the pattern of domestic scrap arising expected.

As concerns imports of secondary materials (estimated for 1985 to reach 15 000 tons for lead and 50 000 tons for zinc), they have been calculated on the basis of present imports, excluding quantities coming from America, which have been assumed to be locally absorbed.

On the basis of forecasts on mining and metallurgical production (calculated as 92 % of capacity), on domestic scrap arising and on consumption, EEC balance of lead and zinc for 1985 is reported in tables 24.7.1 and 24.7.2.

The degree of foreign dependance of EEC for raw material supply up to 1985 has been calculated by assuming to feed up to saturation the metallurgical plants of the Community.

On the other hand, in the case of zinc, assuming sufficient imports to meet total demand, the requirement of imported materials would be reduced by 150 000 tons. Also, the excess of slab zinc production as compared with consumption is lower than 10 % and would be cancelled in the immediately following years, as a consequence of the increase of demand.

TABLE 24.7.1.

LEAD BALANCE IN EEC - 000 TONS

	1972	1976	1985
Mine production (1)	169	135	230
Net import of concentrates (1)	251	196	275
Production of lead bullion from ores	400 °	315 °	480
Net import of lead bullion	202	235	190
Production of primary refined (2) lead	575	568	650
Net import of refined lead	146	114	40
Secondary production (3)	607	624	910
from domestic scrap	536		895
from imported scrap	71		15
Total consumption	1301	1308	1600

N.B.: Mine production includes Greenland in the forecast

(1) Metal content

(2) Excluding the "other materials" of table 21.2.10 a

(3) Metal recovered

° Estimated

TABLE 24.7.2.

ZINC BALANCE IN EEC - 000 TONS

	1972	1976	1985
Mine production (1)	364	332	730 (2)
Net import of ores (1)	765	919	950
Slab production from ores	1033	1030	1565
Slab production from secondary materials	120 °	100 °	205
Total slab production	1153	1130	1770
Net import of slab	134	9	- 150
Slab consumption	1353	1207	1620
Direct use of scrap (3)	285	379	580
Net imports of zinc alloys	23	25	
Total consumption	1661	1611	2200

N.B.: Mine production includes Greenland in the forecast

(1) Metal content

(2) Including 30,000 tons of primary residues

(3) Metal recovered

° Estimated

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