DESCRIPTION AND JUSTIFICATION OF THE PROPOSED EXPANSION OF THE EREĞLİ STEEL PLANT

Submitted by
EREĞLİ DEMİR VE ÇELİK FABRİKALARI T.A.Ş.
Ankara, Turkey

April 27, 1967

CONTENTS

TABLES

DESCRIPTION AND JUSTIFICATION OF THE PROPOSED EXPANSION OF THE EREGLI STEEL PLANT

I. Introduction

The basic, general objective of Erdemir as set forth when the project was first conceived was to facilitiate the economic development of Turkey. This basic objective entailed establishing a private enterprise to build and operate a steel plant capable of supplying the country's flat product requirements. Furthermore, as a subsidiary objective, the original plan recognized that subsequent expansion steps must be anticipated in order that the Eregli Plant would keep pace with growing market requirments, and to increase the operation to a more nearly optimum economic size by "rounding out" the basic capabilities provided in the initial plant design. An inherent objective, predicated on the fact that a private enterprise was the chosen vehicle for accomplishing the stated objectives, was that this operation should be successful financially.

II. The Proposal

As the Armco Report so aptly put it, within two years of the start of operations the Eregli Plant has proved its potential production capability, and is now at a most critical point in its growth. Projected market requirements clearly show that Eregli's production capability must be expanded. Because of the company's present unsatisfactory financial condition, the problem of expansion has been considered with a view towards the minimum capital expenditure program that will permit the achievement of satisfactory production levels and also improve profitability through more complete facility utilization. It is thus proposed that Erdemir undertake immediately to implement a capital program totalling approximately $26 million, including both foreign exchange and local costs.

Erdemir requests that the necessary approvals and actions be effected to provide financing for this program according to the following plan (all amounts in equivalent U.S. dollars):

U.S. Dollar Purchases - U.S. AID Loan	$18,350,000
European Purchases - Contingent on arranging satisfactory credit terms	2,800,000
Lira Costs in Turkey - Availability of funds to be guaranteed by Government of Turkey	5,050,000
Total	$26,200,000

The proposed capital program is detailed in Table 6 on page 48 ; its principal elements according to basic production areas are summarized here, and are described in the section beginning on page 33 .

(a) Increase hot metal production.

This involves blast furnace modifications, including the installation of a fuel oil injection system, high top pressure, and expanding the hearth at the time the furnace is relined (the reline is also incorporated in this program). An integral part of this phase of the program is the importation of foreign ore to augment the available Turkish ore which will continue to be purchased at the rate of about 600,000 metric tons per year.

(b) Increase molten steel production.

This involves the installation of an additional oxygen plant like the one now at Eregli, revisions to the scrap preparation and charging facilities (and the importation of scrap to supplement plant generated scrap as required), and other necessary additions and modifications in this area.

(c) Continuous billet casting facilities.

This will be a new operation for Eregli, which will permit the

plant to make better use of its hot metal and steel production capabilities, and at the same time provide billets for a substantial part of the Turkish market for this product which otherwise would require importations.

(d) Increase rolled product output.

The several things proposed here do not involve large investments, but all are important, including a roll side shifter for the combination mill, a side trimmer and scrap chopper and conveyor for the continuous pickling line, additional annealing capacity, and required building extensions. Also, a key part of the program to increase flat rolled product output is the adoption of "alternate rolling" to increase the effective useable time on the hot strip mill.

(e) General facilities, material-handling equipment, and electrical installations.

A number of additions and modifications in the way of general facilities, material handling equipment, and revisions to the electrical systems must be undertaken in connection with the proposed expansion.

If this program gets underway now it can be completed by the end of 1969, and "start-up" or "shake-down" of the new facilities would thus be implemented in 1970. (It is now estimated that the reline of the blast furnace will occur late in 1969 or in 1970, but this cannot be forecast accurately at this time and the projections accompanying this report have not reflected a blast furnace shut-down period.) A comparison of 1971 production from the expanded plant versus the "design capacity" of the present plant is as follows (in metric tons):

	Original Design	1971 (Expanded)
Hot Metal	440,000	660,000
Steel from BOF	470,000	866,000
Continuously cast billets	-	262,000
Blooms (for rerolling into billets at Karabuk)	110,000	-
Flat rolled products	268,000	420,000

III. Summary Justification

A. Meeting Market Requirements

As stated in the introduction, one of Erdemir's basic objectives is to provide Turkey's flat product requirements. As expected, the markets for these products are growing, and Eregli must grow too if it is to serve the country's economy most effectively. Furthermore, it is important that expansion plans be finalized in advance of actual market requirements, not only because steel plant installations obviously require a long "lead-time", but because the growth of the steel consuming industries is in part a function of anticipated availability of their basic raw material - steel from Eregli. In other words, Turkish manufacturers who anticipate that a limiting factor in their operations will be availability of steel will be much more likely to expand their operations if they know that Eregli in turn is expanding and will be able to meet their requirements in the future.

Market studies have been made by several parties, including the Turkish Government's State Planning Commission, the Armco survey team, and by Erdemir and its Koppers advisors. Compilations of the projections based on these several studies are presented on pages 20 through 23 of this report, and while there is some variation in their findings they are unanimous in that substantial growth in the flat products market in Turkey

must be anticipated. Even the most conservative of these projections indicates that by 1970 requirements for flat rolled products will exceed Eregli's present total flat product capacity, even after considering the boost which "alternate rolling" will provide to hot mill production.

Another aspect of market requirements which had been part of Erdemir's original objectives only in a secondary way is that of billet production. The original plan had included 110,000 tons of Eregli product which were to be rolled into billets by Karabuk. This program has only been partially effected, and this only lately, because Karabuk's rolling capacity apparently has been allocated to their other steel products. The Turkish Government has therefore asked Erdemir to install billet production facilities to relieve the requirements for imported billets. The market studies mentioned above differ widely with respect to billet market projections, but here again the most conservative figures for 1970-1971 still exceed the projected level of production from Eregli with its continuous casting facility. The limiting factor here will be the availability of hot metal, which will be directed first towards the production of the relatively more profitable finished products.

In 1971, Eregli would be able to produce 260,000 tons of continuously cast billets, or more than 85% of the "low" Armco projection of market requirements. This percentage would taper off in subsequent years as increasing flat product requirements use more of the BOF's output. Eregli's billet sales curve would thus in effect serve to fill in any gaps that may occur between optimum steel production levels and ingot requirements for rolling into flat products.

B. Utilizing Plant Facilities Effectively

The preceeding reference to the continuous casting facility serving to "fill the gap" is indicative of the effort in this program to achieve optimum plant utilization at minimum capital cost. As has been

mentioned, the original plant was designed with subsequent expansion in mind. The optimum production capabilities of both the blast furnace and BOF shop, for example, are much greater than the initial so-called "design capacity", and the same is true of the finishing end of the rolling mill facilities. Thus with some rather minor additions and modifications Erdemir is able to boost both its raw steel production and its finishing capability to meet growing market demands.

The fact is that the inherent capabilities of both the hot metal and steel production units on the one hand the finishing facilities on the other hand are separated in the production sequence by what may be considered a bottleneck - the hot rolling facilities. The capacity of the hot strip mill is a function of finished product mix, and based on present market projections it appears that this unit will be able to handle requirements until about 1972. Flat product output would then level off, unless other programs are implemented as discussed in the last section of this report.

In order to take the fullest advantage of the increased blast furnace and BOF production made possible by the proposed modifications and the move to import iron ore, it is necessary to find a way to utilize a large amount of steel without having to put it through the hot rolling part of the production sequence. Continuous casting is the obvious answer.

The situation in the finishing end of the plant is similar, in that some relatively minor additions and modifications will enable Eregli to boost its flat product tonnage substantially. Here again, and at even less relative cost, the proposed capital expenditures should be viewed as necessary steps, not only to meet market requirements but to "round out" and more completely utilize the now latent production capabilities of the original equipment.

C. Improving Financial Performance

The third and probably truly basic reason for urging immediate approval of this proposed capital program, insofar as Erdemir itself is concerned, is the fact that it will improve the company's financial performance very substantially. Detailed Cash Flow Statements are contained in the Financial Performance section of this report. The tabulation below shows a comparison of cash flow for 1971 (the first year of full operations of the expanded plant) versus 1968 (when production and sales are expected to be at the level of the "design capacity" of the existing plant before expansion). The figures shown here are before debt service requirements, and they exclude expansion loans and capital expenditures in 1968, even though these do "net out", so as not to distort the comparison of each of these elements of net cash flow versus 1971.

	1968	1971	Difference
		(In millions of TL)	
CASH FLOW			
Sources	752	1,257	505
Requirements	591	835	244
Net Cash Generated by Operations	161	422	261

These figures show the incremental cash flow which is largely attributable to the proposed expansion to be 261 million lira or approximately $29 million. Thus the indicated incremental cash flow (before debt service) for 1971 alone exceeds the total amount of new capital investment required for this expansion, or in other words the "pay-back period" on this investment is less than one year. These figures have been considered before debt service, since in its simplest form the basic purpose of such an analysis is to measure an investment's cash

generating ability per se against the amount of the investment. It is not considered necessary to go into a sophisticated cost of capital or discounted cash flow analysis when this simple pay-back period test gives such an extremely favorable answer.

Turning to the Earnings Statements accompanying this report also makes apparent the very favorable results which the proposed expansion will make possible. Profit before interest is expected to rise from 47 million TL. in 1968 (when operations are at the level of the original "design capacity") to 338 million TL. in 1971. The profit after interest shows an improvement of even greater magnitude.

IV. Turkish Market Requirements

As mentioned in the previous section, market studies have been made by the Armco survey team and by Erdemir, both with the assistance of Koppers. The Turkish Government's State Planning Organization also has compiled detailed projections of Turkish market requirements for Eregli's products. Tabulations showing these several projections are found at the end of this section as follows:

Table 1	-	Armco "Low" Market Projection 1967-1975
Table 2	-	Armco "High" Market Projection 1967-1975
Table 3	-	State Planning Organization Market Projection 1967-1972 and 1977
Table 4	-	Erdemir Market Projection 1967-1975

A. The Bases of the Market Projections

Some comments on the bases for these projections are in order. The Armco projections are based on a three-week study done in Turkey in July and August 1966, with the assistance of the Erdemir sales organization and its Koppers advisor. Armco projected steel consumption growth rates in terms of a probable range (e.g. 7 to 10 percent annually), and

thus compiled two sets of projected steel usage - one based on the low-side of each growth range and one based on the high-side of the range. The Armco study included personal contacts with about 40 Turkish steel consumers as well as others in Turkey having first-hand knowledge of this matter. The relationships and correlations between steel usage and the Turkish economy in general and certain pertinent segments also were studied as a means of establishing the subject projections. In closing its report on its study of the Turkish steel market, Armco stated that its "low" and "high" projections of steel demand are not meant to represent the extremes of growth that could occur in the future. Instead, they are intended to show the range of demand that seems most likely if economic activity in Turkey rises at about 6 percent annually from 1966 to 1970 and about 7 percent annually from 1970 through 1975. The Armco steel market projections show higher growth rates than this, but taper off in the latter part of this period, since the basic product, steel, is very much of a "leader" or foundation element in an evolving economy. Armco's "low" market projection for Eregli flat products shows 16.8 percent growth in 1968 dropping off to 7.0 percent by 1975. The "high" projection is 17.5 percent in 1968 and 7.2 percent in 1975.

The projections provided by the State Planning Organization apparently were calculated on the basis of statistical relationships with certain basic economic indicators as they in turn are forecast for the country. These figures show an annual growth rate of just over 11 percent, but because they start with a higher estimate of the present year's figure they foresee substantially higher volumes in each of the projection years than shown in the Armco projections.

The Erdemir projections, prepared in conjunction with the Koppers Marketing Advisor, show a slightly lower annual growth rate (11 percent), but also start from a higher base year than the Armco projections. They

too are thus somewhat higher for any given year than the Armco figures. The Erdemir-Koppers projections are based on first-hand, continuous contacts with the approximately 1,000 fabricators and distributors which service the 4,000 flat product steel consumers in Turkey. Through these close contacts the Erdemir field sales offices and their advisor have become acquainted with the objectives, needs, and expansion plans of their customers, as well as with marketing conditions and projections for the products of these customers. This extensive and continuous relationship with the market place itself is in essence the basis for the projections shown in Table 4.

In the interest of conservatism, the financial projections incorporated in this report have been based on the Armco "low" market projections as shown in Exhibit I. As suggested by Armco, the "high" Armco projection has been used for facilities planning purposes.

One thing is clear from these several and somewhat varying projections, and that is that the Turkish market for Eregli's products promises substantial growth during the next decade, and for this reason it is imperative that the proposed expansion program be implemented immediately.

B. Important Market Segments

Following are comments and observations regarding the major market segments for Eregli's products.

1. Agricultural and Other Non-Electrical Equipment

In Turkey, as has been the history in other countries, people that had been engaged in agricultural pursuits in and around the small villages are migrating to the cities. This migration is caused by workers seeking more profitable employment in the expanding industries in the cities, and it will continue. At present, one Turkish agricultural worker feeds only five persons including himself. In the U.S.A., by comparison, one agricultural worker feeds 30 people. As agricultural labor becomes

less available, machinery is becoming more important and is being used much more extensively to increase agricultural production.

There are many other types of non-electrical equipment which are manufactured in Turkey, and many of these are also related to the basic problem of feeding the country's growing and more urban population. These include equipment used in processing meat, milk, butter, cheese, flour, sugar, edible oils, beer, wine, tea and tobacco, as well as equipment for the canning industry and for cold storage warehouses. Still other equipment made in Turkey - from Eregli steel - is used by the textile, paper and printing industries. Following is a list of some of the principal Turkish manufacturers of agricultural and other non-electrical equipment.

1. MKEK - ANKARA
2. Minneapolis Moline Turk - ANKARA
3. Altinova Ziraat Alet ve Makina - ADANA
4. Ibrahim Ors Ziraat - ANKARA
5. Necip Oguz Teknik - GAZIANTEP
6. Aytekin Kenli - IZMIR
7. Fehmi Ertan - ESKIŞEHIR
8. Neset Pazarpaşi - ESKIŞEHIR
9. Guven Is Koll. - ADANA
10. Ihsan Turkeli - IZMIR
11. Ima Mamulleri Yik. Muh. - IZMIR
12. Demir-Çelik Dokum - ISTANBUL
13. Makina Ima. Koll. - ISTANBUL
14. Nam Ticaret ve Taahhut - IZMIR
15. Turkiye Şeker Fab. - ESKIŞEHIR
16. Sungurlar - ISTANBUL

2. Automotive

Much activity has arisen in this area of the Turkish economy since Erdemir came into the picture. Chrysler, in Istanbul; British Motors Corp., in Izmir; and Turk Otomotif Endustrie in Istanbul have built large new plants to manufacture frames, bodies, and other component parts for trucks. Several major producers are contemplating the production of passenger cars in the near future. Other manufacturers and assemblers in this field are:

1. Otosan - ISTANBUL
2. Adalet Karoseri - ANKARA
3. Geneto - ISTANBUL
4. Ciftciler - ISTANBUL
5. MKE - ANKARA
6. Leyland - KOCAELI
7. Turk Willys - Overland - ISTANBUL
8. Otoyol Sanayii - ISTANBUL
9. Deutz (Magirus) - ISTANBUL (unver)
10. Arçelik - ISTANBUL
11. Ilyas Karabuk - SAMSUN
12. Çelik Montaj - ISTANBUL
13. Standard Kelde - ISTANBUL
14. UZEL Ticaret - ISTANBUL
15. Kaiser Jeep - ISTANBUL

3. Construction

Construction activity is a leading indicator of the activity in other segments of a country's economy, and construction is growing in Turkey. Housing construction has been and is continuing to be a strong factor, and industrial construction is accelerating. Many new

uses for Eregli steel products are found in construction applications. Wood is being replaced by steel for window and door frames and in cabinets in new apartments, other residential buildings, and hotels. The use of steel in tanks both under and above round, and in other structures is growing rapidly with the expansion of the oil companies and gasoline stations. With the advent this year in Turkey of quality galvanized sheet made from Eregli's cold rolled sheets, a revolution will be taking place in the construction of simple farm and industrail buildings. The use of galvanized roofing and siding will also stimulate additional consumption of hot rolled sheets and plates as formed or fabricated structural members. Fabricated steel sections are already being used in a lot of construction in place of concrete members. There are many, many small Turkish firms involved in various phases of construction that are present or potential customers for Eregli steel.

4. Household and Commercial Appliances

This market is rapidly expanding as evidenced by the many enlarged and new plants which have come into being since Eregli was built. There are now approximately two hundred plants in Turkey manufacturing electric, gas, and fuel oil household appliances such as cookers, irons, water heaters, refrigerators, washing machines, vacuum cleaners, stoves, office furniture and equipment, and household and garden furniture. There were very few firms doing much in this area prior to the domestic production of sheet steel required for these items. Following are some of the principal firms in this business served by Eregli.

1. Arçelik - ISTANBUL
2. Profilo - ISTANBUL
3. Auer - ISTANBUL
4. Emayetaş - ISTANBUL
5. Nurmetal - ISTANBUL
6. Elter - IZMIR

7. Muriş - IZMIR
8. Talisman - ISTANBUL
9. Turk Demir Dokum - ISTANBUL
10. Maraton Gaz Aletleri - ISTANBUL
11. Levent Gazocak - ISTANBUL
12. Genckut Koll Sti. - IZMIR
13. Bekir Karahan - ISTANBUL
14. Seydi Guney - ISTANBUL
15. Alp Soba San. ve Tic. - KAYSERI
16. Safak Sobalari - KONYA
17. Dogu Madeni Esya End. - ISTANBUL
18. Himket Kahraman - ISTANBUL
19. Migogos Atiniz - ISTANBUL
20. Kardesler Termosifon - KAYSERI

5. Canning (Food, Oil and Margarine)

After a great deal of effort by Erdemir technical and sales personnel and their advisor, the Turkish food canning industry now is willing to use Eregli's electrolytic tin plate rather than the hot dipped product they had been using. Imports of tin plate have now been shut off, and sales of Eregli tin plate are rising rapidly. Sales for containers for petroleum products, paint, medicine, and bottle caps are also contiuing to grow, and orders for this year might exceed the plant's tin plate production capability.

New equipment for lacquering, lithographing, and can making at Tasaş., a complete new plant for the same type of production at Metal Kapak, and a new bottle top plant at Kapsul in Izmir are only a few instances of the rapidly expanding activity in the can making field.

Plans for expansion of food canning facilities at Tamek in Bursa and Vatan in Istanbul are awaiting assurance of Erdemir's ability to produce the additional tin plate that would then be required. Fish and food canneries in the Dardenelles area and Et ve Balik Kurumu in Ankara are all planning more production. Vegetable oil canneries all over Turkey are trying to boost their output, and margarine production is increasing. There are approximately 600 canneries in Turkey, and this key growth industry certainly will be requiring increasing quantities of tin plate from Eregli.

6. Electrical Equipment

This field is one of the latest developments in Turkey, and it is rapidly expanding to meet the needs of the domestic market. At present, Turkey can only produce about 50% of its electrical equipment requirements, generally of a less complicated nature. Typical manufactured components requiring steel are switches, street lighting equipment, distribution and control panels, junction boxes, connecting blocks, lighting fixtures and transformers. In addition, fabricated steel sections are required for transmission towers (some fabricated sections) and for internal cable carriage and hardware. Major manufacturers in this field are:

1. Emtaş - ANKARA
2. Ak Ticaret Ergun Akcetin - ISTANBUL
3. Emfa - ISTANBUL
4. Kostantin Kulutras - ISTANBUL
5. Simko - ISTANBUL
6. Super - Selcuk Demet - ISTANBUL
7. Nurmetal - ISTANBUL
8. Turk General Electric - ISTANBUL
9. Nuriş Tic. - ANKARA
10. Alarko - ISTANBUL

7. Railway Equipment

The Turkish State Railroads Administration operates 46 locomotive maintenance and repair shops, 30 workshops for repair of cars, and 11 inspection shops. Major repairs and rebuilding, as well as certain manufacturing, are done in four large plants at Ankara, Sivas, Eskişehir, and Adapazari.

The Railroad Administration is planning to retire 307 steam locomotives in 1967 of the total 900 in use and replace them with 179 modern, powerful locomotives. A total of 4600 freight cars, 407 suburban and 50 mainline passenger cars also must be replaced.

With the decline in the number of steam locomotives, it has not been necessary to create additional repair facilities for them, but repair facilities in the East and Southeast where the remaining engines will be used have been expanded. Facilities in Eskişehir have been moved to Sivas for this purpose. In the premises vacated by the removal of steam engine repair facilities at Eskişehir, a diesel locomotive manufacturing shop may be set up with a capacity of 30 locomotives per year. These new facilities would manufacture all fabricated section and sheet components of the locomotives, and large frame sections would be formed and fabricated. Eregli hot rolled sheets and plates would be used. The Railroad Administration's freight car manufacturing capacity is now 1,000 cars per year. This is being expanded, and the passenger car manufacturing capacity of 250 cars per year is being doubled with new facilities at Adapazari. Eregli hot rolled sheets and plates, as well as cold rolled sheets, play a major part in these programs.

8. Shipbuilding

The objective of the Turkish shipbuilding industry is to produce all domestic requirements and to compete with foreign shipbuilders in the world market. New facilities have been constructed in Istanbul, and the Turkish Maritime Commission is doing a great deal of planning in an effort to achieve this objective.

Plates for shipbuilding are included in the Erdemir-Koppers market projection, but there is a price differential now existing in favor of imported plates on which there are no customs or other duties. There is shipbuilding capacity now in Turkey to consume over 50,000 metric tons of plate per year, and ways are being sought to allow Erdemir to supply this demand without jeopardizing the position of the Turkish shipbuilders in the world market.

9. LPG Containers

The use of liquid petroleum gas (LPG) for heating and cooking is expanding rapidly in Turkey. Capacity for LPG production tripled in 1966, and is continuing to expand. Facilities for the production of LPG containers made from Erdemir hot rolled sheets are being expanded by Osman Malak and Gaz Aletleri, A secondary, but by no means insignificant effect of expanding LPG usage is the increase in production of heaters and cooking stoves, also made from Eregli steel.

10. Steel Pipe

The housing construction boom alone is providing substantial impetus to the market for steel pipe in Turkey. In addition, the installation of gas and water transmission lines, and expansions in the petroleum, paper, rubber, and chemical industries in Turkey are adding to the demand for steel pipe. A feasibility study is now being made for a high pressure gas line between Turkey and Iraq. It is expected that this line initially will contain 1100 miles of 30" pipe, 350 miles of 24" pipe and 150 miles of 20" pipe, not counting the miles of laterals extending in all directions from the main line. Included in this study is a plan for a new pipe plant to be build in Iskenderun. Pipe is now manufactured by Mannesman-Sumerbank and Boru Sanayii in Istanbul, both substantial Eregli customers for skelp. Mannesman has added one spiral weld line and one resistance weld line to

its facilities, and Boru Sanayii has built a new plant with one additional resistance weld line since Eregli began production of skelp.

11. Billets

The billet market will be a new endeavor for Erdemir, as it moves into production with its proposed new continuous casting plant. Eregli has been involved in this market to a modest extent through the production of blooms which are then rolled into billets at Karabuk and sold to the customers by Erdemir. The principal market for billets is for rerolling into reinforcing bars and other rods of that type.

There are currently 82 major rerollers in Turkey having a combined capacity for billet consumption of some 500,000 metric tons per year. These rerollers are operating at less than 50 percent of this capacity, as they are finding it difficult to get the billets they need. The two production sources in Turkey - Karabuk and Metas - have limited their production for outside sales, and users have also experienced difficulty in arranging for importations. In 1966 there were 176,000 metric tons of billets imported, and it is estimated that total billet consumption in 1967 will be about 225,000 metric tons.

Increased activity in the construction industry, as noted earlier, is putting the pressure on for more billets, and the government has requested that Eregli produce as much as it can as soon as it can. The Erdemir-Koppers market projection shows billet requirements growing at a rate of 10 percent per year. This puts the 1971 billet market at about 330,000 metric tons, essentially the same level as shown in the Armco "high" market projection. The State Planning Organization's projections for the billet market are much more optimistic.

In closing this section of the report, it should be emphasized by repeating that one of Erdemir's basic objectives is to provide Turkey's flat product requirements. These market requirements are growing, certainly

and rapidly, and Eregli must grow too. Also as mentioned, the growth of steel consuming industries is predicated on assurance that their most basic raw material - Eregli steel - will be available as they need it. It is for these reasons related to the Turkish economy that Erdemir must get on with its expansion program now.

ARMCO'S "LOW" MARKET PROJECTION
1967 - 1975

Table 1

PRODUCT	Metric Tons per Year								
	1967	1968	1969	1970	1971	1972	1973	1974	1975
Tin Plate	33500	37500	41000	45000	49000	53000	57000	61000	65000
Cold Rolled Sheets	52500	59000	65000	72000	80000	88000	96000	104000	112000
Cold Rolled for Galvanizing	-	-	-	33000	37000	41000	45000	49000	53000 *
Hot Rolled - Pickled	16000	20500	24500	29000	32000	34500	37500	40000	43000
Hot Rolled - Unpickled	33000	42000	51000	60000	66000	71500	77500	83000	89000
Skelp	73500	84000	94500	105000	112000	119000	126000	133000	140000
Plate	28500	32500	36000	40000	43500	47000	51000 *	54500 *	58000 *
TOTAL	257000	275400	312000	[illegible]	419500	454000	490000	524500	560000
Growth % Year		16.2	13.0	35.0	9.0	8.2	8.2	7.0	7.0
Billets	40500 **	40500 **	105000	200000	302000*	334000*	548000*	368000*	390000*
Pig Iron	64000	78500	92500	107000*	117000*	127000*	137000*	147000*	157000*

* Includes imported product

** From Eregli Blooms

Table 2

ARMCO'S "HIGH" MARKET PROJECTION
1967-1975

PRODUCT	Metric Tons Per Year								
	1967	1968	1969	1970	1971	1972	1973	1974	1975
Tin Plate	34500	39500	44000	49000	54000	59000	64000	69000	74000
Cold Rolled Sheets	53500	61000	68500	75000	85000	94500	103500	113000	122000
Cold Rolled for Galvanizing	-	-	-	33000	37000	41000	45000	49000	53000 *
Hot Rolled - Pickled	17000	21500	26500	31500	35500	39500	43500	47500	51500
Hot Rolled - Unpickled	34500	45000	55000	65500	74000	84500	91000	99000	107500
Skelp	73500	84000	94500	105000	112000	119000	126000	133000	140000
Plate	29000	33500	37500	42000	47000	66500*	56500*	61000*	66000*
TOTAL	242000	284500	326000	402000	444500	504000	529500	571500	614000
Growth % Year		17.5	15.0	24.0	10.2	13.4	5.1	7.9	7.4
Billets	40500**	40500**	175000	300000	332000*	364000*	396000*	428000*	460000*
Pig Iron	64000	78500	92500	116000*	125000*	139000*	155000*	171000*	187000*

* Includes imported product.

** From Eregli Blooms

STATE PLANNING ORGANIZATION MARKET PROJECTION
1967 - 1977

Table 3

PRODUCT	Metric Tons Per Year						
	1967	1968	1969	1970	1971	1972	1977
Tin Plate	46000	49500	53100	57700	62300	67700	98500
Cold Rolled Sheets	75400	90800	109200	131700	159000	194400	371100
Cold Rolled for Galvanizing	37000	41300	45400	49900	54900	61500	107500
Hot Rolled Sheets	80000	90300	102100	115500	130500	148000	285900
Skelp	55000	60000	68200	75900	83600	95000	162900
Plate	16000	15700	17300	20800	25300	27200	55900
TOTAL	309400	347200	395600	450700	515400	593800	1081800
Growth % Year		11.2	11.4	11.4	11.4	11.6	16.0
Billets	520000	580000	650000	725000	810000	910000	1600000
Pig Iron	115000	129400	146200	165200	186700	205500	400400

Table 4

EREGLI - KOPPER'S MARKET PROJECTION
1967 - 1975

PRODUCT	Metric Tons Per Year								
	1967	1968	1969	1970	1971	1972	1973	1974	1975
Tin Plate	55000	61000	67000	74000	82000	90000	99000	109000	120000
Cold Rolled Sheets	57000	64000	72000	81000	91000	102000	114000	128000	143000
Cold Rolled for Galvanizing	25000	29000	34000	39000	45000	52000	60000	69000	79000
Hot Rolled - Pickled	20000	23000	27000	31000	36000	41000	47000	54000	62000
Hot Rolled - Unpickled	38000	43000	48000	54000	61000	68000	76000	85000	96000
Skelp	110000	121000	135000	147000	162000	178000	196000	216000	234000
Plates	52000	55000	58000	61000	64000	67000	71000	75000	79000
TOTAL	358000	397000	459000	487000	540000	598000	663000	736000	813000
Growth % Year		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Billet	225000	247500	272000	300000	329500	362500	400000	440000	484000
Pig Iron	110000	121000	133000	147000	162000	178000	196000	216000	234000

V. Plant Facilities

A. Improving Plant Facility Utilization

The original Eregli plant is a small integrated steel plant, by world standards, and it was designed with subsequent expansion in mind. Many of the original production units have more basic capability than specified by their so-called "design capacity". The presently proposed expansion program has been carefully planned to "round out" and more completely utilize the now latent production capabilities of the original equipment. This approach is in keeping with the effort to hold the amount of capital expenditures to a minimum level and still permit attainment of production levels to meet growing market demands. Comments on each of the basic areas of this program follow:

1. The Cold Rolling and Finishing Mills

In considering this program, attention is first directed toward the cold rolling and finishing end of the production sequence at Eregli. This is the area which gets first priority in production planning, because generally speaking the more finished the steel product the more profitable a line it is. The cold rolling and finishing mills at Eregli have considerably more capacity than is now being utilized, and additional output can be handled by removing two limiting factors in this area. One is the annealing operation, and the proposed program therefore includes provision for adding three more furnaces, bringing the total to 18. The other is in the slitting operation, where at present hot rolled coils for tin plate and light gauge cold rolled sheets are being passed through the slitter for a preliminary side-trim to prepare the edges for light gauge rolling on the four-stand cold reduction mill. Some of these products had been delivered to customers with rough edges, but as they are beginning to insist on receiving trimmed edges, as is standard practice in the United States, thus putting more pressure on the slitter schedule. This matter will be

corrected by installing a side trimmer at the pickling line, and confining the present slitter to skelp production. Also in the finishing end of the mill, the program includes provision for adding three bays to provide sufficient space for storage of finished and semi-finished coils and sheets, and one bay on the annealing building to insure continuous servicing of the temper mill.

2. The Hot Rolling Mills

Turning to the middle of the production sequence at Eregli - the hot rolling mills - discloses the area that was knowingly going to become the eventual "bottleneck" in the overall plant layout.

The size of this plant, which was based on the size of the market to be served, of course, simply did not warrant the installation of a modern, high tonnage continuous or semi-continuous hot strip mill. The fact is that such a sizable and expansive installation still is not needed or justified at this stage. In view of the increased flat product tonnage that soon will be required, however, it has become necessary for some means to be devised to widen this hot mill bottleneck.

Part of the answer lies in the practice of "alternate rolling", and this plus the many other benefits embodied in the proposed capital expansion throughout the plant will permit Eregli's total flat product output to reach the level of market requirements projected through 1972 or 1973. The relatively minor equipment alterations required in connection with alternate rolling are already being implemented, and are not included in this proposed capital expansion program per se.

The practice of alternate rolling is not a common one, for the simple reason that there are relatively few flat product steel mills as small as Eregli, and therefore doing their hot rolling with a combination two-high, four-high mill and a reversing hot strip mill, as is the situation at Eregli. The larger mills in this business generally have a semi-

continuous or continuous hot strip mill. The practice of alternate rolling has been studied very carefully, and it is now being used successfully at both Dofasco in Canada and at Lone Star Steel in Texas. Also, Blaw-Knox as the equipment manufacturer, and Armco, both agree that the practice of alternate rolling should be adopted at Eregli.

A brief explanation of "alternate rolling" is in order. This term refers to the practice of rolling an ingot to a slab and a slab to a "breakdown" on the same two-high roll set-up on the combination mill, while the hot strip mill completes the rolling of the breakdown to a coil. This is possible because it requires approximately 2½ minutes to produce a slab from an ingot and another 3 minutes to roll a slab to a "breakdown", while the strip mill requires 6 to 6½ minutes to roll a breakdown to a coil. This change in practice will require careful scheduling and timing, but it should boost hot rolled production by some 25 or 30 percent by making it possible to utilize the hot strip rolling facilities 24 hours per day, versus the present 16 to 18 hours with the remainder of the time used for slab rolling.

The proposed expansion program does include two items required to help boost production in the hot rolling mill area. These are a roll side shifter to reduce roll change time on the Combination Mill, and an auxiliary fuel oil system at the slab furnace and soaking pits for use when there are heating gas shortages or outages.

3. The Blast Furnace

Some modifications and additions are also required in the basic iron and steel production areas of the plant. As mentioned, the optimum production capabilities of both the blast furnace and the BOF shop are much greater than the initial so-called "design capacity" of these units. This blast furnace at present is a relatively low producer by world standards,

principally due to the low quality of the burden being charged to it. Also, this unit was pretty much of a "bare" installation, since a minimum investment was desired and yet still be capable of producing the volumes required during Eregli's first years, as has been shown by actual production.

The time is close at hand, however, when increased hot metal production will be required, and the desirability of getting this tonnage up as much as feasible is clearly in order to improve the plant's overall cost per ton performance. The means to this end are in two parts - first by improving the blast furnace burden, and second by making those modifications which were anticipated but not installed when the furnace was built.

The key to improving the blast furnace burden at this time is the importation of high quality, sized iron ore. Such material would not only be of better quality than the Turkish ores now being used, but it has been established that it can be delivered to Eregli at less cost, as the cost of the Turkish ore is unduly high due to the high cost of railroad transportation reflected in the delivered cost of the ore. The program calls for importing iron ore to supplement the Turkish ore, which will continue to be purchased at the rate of about 600,000 metric tons per year so as to give the Turkish mining industry enough ore to maintain its operations. Improving the blast furnace burden by this means will effect several direct improvements, including increasing the Fe content of the charge, reducing the fines being charged so as to permit full use of the air blast to increase the reduction rate, and also to reduce the present high coke rate. This latter factor, which also is affected by the fuel oil injection system mentioned below, will make it possible for the present ovens to meet coke production requirements at the projected level of hot metal production.

The modifications to be made to the blast furnace include the installation

of a fuel oil injection system, and then when the furnace is relined - probably in late 1969 or 1970 - the hearth diamter will be expanded from 26' to 29' 6" and equipment for operating with high top pressure will be installed.

4. The BOF Shop

The next part of the program, which fits in with the increased hot metal production to be obtained, is to increase the production of molten steel at the BOF Shop. This unit also has a great deal more inherent capacity than the so-called "design capacity" of 470,000 metric tons per year. The proposed program will almost double this shop's production capability, bringing it up to some 900,000 tons per year, though actual steel production which is a function of hot metal production may be somewhat lower than this. The BOF charge will include as much scrap as feasible, including imported scrap to supplement plant generated scrap, so as to get as much steel production as possible.

The principal components of the program to increase the BOF shop's production capability are as follows:

(a) The installation of another oxygen plant like the one now at Eregli.

(b) Modification to the existing lime calcining unit to at least double its rated capacity.

(c) Additions to the scrap handling and charging facilities, in order to be able to handle the large additional tonnages to be charged - both from in-plant and purchased scrap.

(d) Provide additional teeming ladles to handle the increased output.

5. Continuous Casting

Bringing molten steel production up to a more nearly optimum level as proposed here obviously makes sense only if there is some use for the

added production. In the case of the present Eregli plant, there is neither the need nor the capability at present to process some 800,000 to 900,000 metric tons of molten steel per year into flat rolled products. There is however another need for this steel in Turkey, as well as a readily available way to provide the capability - and this is to make billets for the Turkish reroller market.

The proposed capital program includes a six-strand continuous billet casting plant. This facility will take 80 to 90 ton heats from the BOF and cast them into billets ranging in cross section from 3 to 6 inches and in length from 10 to 30 feet. The size of heat will be determined by the cross section of billets to be cast, as is the casting speed range. This unit will be capable of a production rate of from 13.5 to 16.3 metric tons per hour per strand.

While the casting rates noted above are engineered amounts which will be incorporated in the design of this plant, the question of translating them into a rated annual capacity figure is not a clear-cut one. This is because the casting operation is wholly dependent on the heats being delivered to it from the BOF. These must not only be at the proper temperature and have the required metallurgical characteristics, but such things as a running stopper in the delivery ladle will make it necessary to divert that heat from the casting unit. It will take time for the Eregli operators to gain the experience essential to good continuous casting practice, but eventually they will be able to get to the point where they can cast 11, 12, or even 13 heats in a 24 - hour period. (It must be borne in mind that this installation will not be a "continuous - continuous" casting plant, and the BOF heat schedules will intersperse heats for continuous casting with heats for teeming into ingots.) The arithmetic of 13 heats per day, averaging 80 tons each, translates into approximately 360,000 tons per year, but it should be recognized that this is not a guaranteed production rate for this unit or even a projected production level for the first few years of operations.

The 1971 projection shows billet production of about 260,000 metric tons, and this will taper off in the next two or three years as more of the BOF's output is directed to ingot production to meet growing demand for flat rolled products. It is expected that the "split" between ingot and billet production will stabilize about 1973 when ingot tonnage will level off at about 630,000 tons due to hot mill capacity limitations, and billet tonnage would then run in the area of 165,000 to 200,000 tons as dictated by the availability of hot metal. Later, when a second blast furnace brings hot metal availability up above requirements for ingot production, the output of billets could be stepped up again.

6. General Facilities

As part of the proposed program it will be necessary to make certain additions and modifications in several general areas such as the utility systems, material handling facilities, and the provision of some additional maintenance equipment. The following section contains a brief description of all of the individual units included in this program.

This section has set forth some of the reasoning that has been incorporated into the proposed Eregli expansion program with a view towards "rounding out" and more completely utilizing the production capabilities of the existing equipment. The results of this planning are shown in Table 5 on page 32 which summarizes production quantities as they are projected for 1971, the first full year of operations after installation and "shake-down" of the proposed additions and modifications. This tabulation shows production quantities by production unit and by type of finished product being produced. The finished product quantities are outlined in each column, and the total volume going through a unit is shown to the right. Then to the far right, the percent of facility utilization is shown. This of course is a function of product mix, as well as the estimated hours available after allowing for such things as repairs and maintenance. Also,

BEST AVAILABLE COPY

for the blast furnace the composition of the raw material charge is a determining factor. An important point to note is that many of the units still will have additional capacity to offer in the future when subsequent expansion programs are implemented.

PRODUCTION SCHEDULE FOR 1971 WITH PROPOSED IMPROVEMENTS

(Finished Products are underlined and overlined)

Table 5

Production Unit	Tin Plate	Cold Rolled Sheets	Hot Rolled Sheets (pickled)	Hot Rolled Sheets (unpickled)	Skelp	Plates	Billets	TONNAGE Total by unit	% of Facility utilization
Tinning Line	49,000							49,000	58%
60" Cold Rolled Shear		117,000						117,000	104
Temper Mill	51,500	130,000						181,500	65
Annealing	52,300	132,000						184,300	91
38" Cleaning Line	52,300							52,300	55
Tandem Cold Mill	53,300	132,000						185,300	48
60" Hot Rolled Shear			32,600	65,400				98,000	30
Pickling Line	53,600	132,600	34,100					220,300	58
Slitter	55,300				112,000			167,300	63
Plate Shear						43,500		43,500	-
Hot Strip Mill	63,300	136,700	35,100	68,300	128,300			431,700	82
Comb. Mill-Plates						49,200		49,200	-
Comb. Mill-Slabs	65,900	142,500	36,600	71,100	133,600	50,500		500,200	89
Continuous Casting							261,500	261,500	72
BOF	77,600	167,600	48,000	83,700	157,200	59,400	278,200	866,700	96
Blast Furnace	59,100	127,600	32,800	63,700	119,700	45,200	211,900	660,000	100

B. Description of Proposed Additions and Modifications

This section presents summary description of the proposed additions and modifications. Detailed descriptions are contained in the "Physical Specifications" prepared by Koppers for this program. Table 6 listing the things covered by this program is presented on page 48 . The following paragraphs are grouped according to major production areas within the plant.

1. Hot Metal Production Facilities

a. Fuel Oil Injection System. The injection of a liquid or semi-liquid fuel into the blast furnace at the tuyeres has been perfected in recent years as a means of increasing production rates and reducing coke consumption. The proposed system will consist of a new oil storage tank, pumping equipment, piping, valves, fittings, controls and fuel oil heating equipment. Injection of the oil through the tuyeres, where the hot blast or wind is introduced around the bosh of the furnace, will create higher heat in the lower ore reduction zone and speed up the process of reducing ore to iron. This fuel oil will replace coke at the rate of one kg. of oil per 1.7 to 1.8 kg. of coke. This will help to keep the coke consumption of the furnace within the capacity limits of the existing coke ovens, and an investment in additional coke batteries will not be required at this time to obtain the increased hot metal production.

b. High Top Pressure. The Blast furnace, as designed, is suitable for adaptation for operation at elevated pressure up to 10 pounds. This is another technique which has been perfected in recent years, and will increase production by

speeding up the ore reduction reaction. It will also reduce dust loss, and the faster reaction of the reducing elements will help to minimize coke consumption. The equipment for operating at elevated pressure will be installed when the furnace is down for relining. This will include the installation of equalizer and relief valve equipment and controls, gas cooler water level equipment and controls, and bleeder valve equipment and controls.

c. Blast Furnace Reline. Normally a blast furnace lining must be replaced after five to seven years of operations, and the Eregli furnace thus will have to be relined sometime in the 1969-1971 period. Since it is not possible to ascertain just when the old lining is going to wear out, it is absolutely essential that the replacement lining be on hand so as to minimize the furnace down-time. The furnace reline work will consist of replacing the wearing plates and the refactory lining in the stock and in the bosh. As a result of the hearth expansion described below, the new lining in the bosh and hearth area will be thinner than the original lining. Also, worn copper cooling plates in the stack will be replaced.

Relining a furnace is ordinarly considered as a long cycle maintenance project, and production costs have included an accounting provision for a bookkeeping reserve for relining. This project is included in the proposed expansion program because the work will be done in conjunction with all the other elements involved in this program.

d. Blast Furnace Hearth Expansion. The blast furnace's capacity can be increased by expanding the hearth diameter from the present 28 feet to 29 feet 6 inches at the time of relining. This will

give greater iron holding capacity, and a larger final reduction zone for increased hot metal output. The changes to the furnace to accomplish this include the following:

- The sidewalls of the hearth to the centerline of the tuyeres will be lined with carbon block.
- The number of columns will be reduced from ten to eight and the remaining columns reinforced. The mantle will be altered to support the stack and top structure.
- New tuyere jackets will be provided, and the number of tuyeres will be increased from 20 to 24.
- Twenty-four new blow pipes will be installed.
- The bustle pipe will be altered and relined.
- Bosh bands will be re-rolled and provided with inserts.
- Shorter cooling plates will be provided for the bosh area and the number of plates per row will be increased.
- Eight rows of addtional cooling plates will be provided for the stack.
- A new water circle pipe and new booster pumps will be provided.

2. Steel Production Facilities

The existing BOF shop, with two vessels operating on alternate campaigns, has the potential capability of producing 900,000 metric tons per year of steel at an availability of 95 percent (347 days per year) and a heat time of 50 minutes from tap to tap. To achieve this production level, however, additions must be made to certain auxiliary facilities.

a. Oxygen plant. The present oxygen plant, supplied by Air Liquide of France, was sized to provide oxygen for 17 heats per day in keeping with the original "design capacity" of the BOF shop. In order to boost steel production it will be necessary to install a second oxygen plant, and a unit essentially a duplicate of the existing plant is proposed.

This will facilitate such matters as the carrying of spare parts, maintenance, and the making of the necessary alterations in controls and piping to permit operating the two plants in "tandem". No additional oxygen storage facilities will be needed. This arrangement will provide some excess oxygen capacity which would be available for subsequent increases in steel production. In the meantime, this oxygen could be used to experiment with oxygen injection in the blast furnace. A new electrical substation will be also required in the oxygen plant area.

b. Lime Kiln alterations. BOF steel making requires burnt lime made from limestone in a kiln. The existing unit is a Union Cargide plant of the vertical type which was designed so that its capacity could be doubled with relatively minor changes. The alterations required include a new drive for the exhaust fan, modifications to the burners, additional dust collecting capacity and changes to certain instruments and controls.

c. Steel ladles. Nine teeming ladles are currently in use at the BOF shop for receiving molten steel from the furnaces. The additional heats which will be produced after this program is implemented, including both production for ingot casting and for continuous casting, will require three additional teeming ladles. These new ladles should be completely interchangeable with the present facilities.

d. Scrap preparation. In order that Eregli can make the fullest use possible of all iron units available it is proposed that a skull cracking area be provided for breaking up molds, stools and skulls for remelting in the BOF vessels. An existing crane will be equipped with a skull cracker ball and an electromagnet. A scrap pit area will be provided lined with heavy timbers on the sides.

e. Scrap handling and charging. As mentioned, part of the means to achieving a greater steel production level from the BOF shop is by increasing the scrap portion of the charge.

It is planned to approach a 30 percent scrap - 70 percent hot metal ratio, including the importation of scrap as necessary. Facilities must be provided so that the proper weight of scrap can be charged to the BOF vessels with sufficient speed, and not be a deterring factor with respect to heat time. To do this, it is necessary to install a low level scrap crane that will have the sole duty of filling the scrap boxes on a transfer car. The scrap aisle will have to be extended four bays, and the crane rails will have to be extended four bays in the opposite direction within the end of the existing scrap aisle. The existing scrap boxes also must be modified by adding flared side plates.

3. Continuous Casting Facilities

A continuous casting plant will be built immediately south of the BOF teeming aisle. This plant will have the following features:

Number of Strands	Six. This will permit taking full heats from the BOF, and avoid the splitting of heats as would be necessary with fewer strands.
Primary Metal to be Cast	Carbon Steel (killed grades)
Size of Heat	80 to 90 metric tons. The size of heat is determined by cross section of billet. The 75 mm2 billet will take an 81 ton heat, and the 100 mm2 billet a 90 ton heat.
Size of Billets	76 mm (3 inches) to 152 mm (6 inches) square
Expected Production Rate	13.5 to 16.3 metric tons per hour per strand.

Billets will be cast vertically, bent to the horizontal, straightened, cut to length by shears, discharged onto a transfer conveyor, stacked and accumulated on a cooling bed.

This plant will be equipped with instrumentation and controls to assist operator functions and to record essential information related to the casting operation. The building design will include an office on the operating floor, a convenience room at the spray chamber floor, and an electric equipment room at the machinery floor.

Ventilation which is extremely important for the dissipation of heat will be accomplished through a roof monitor running the length of the building. Heat and water vapor generated in the spray chamber will be exhausted by fans through insulated ductwork to a point outside of the building. Radiant heat from the billets between the spray chamber and the pinch rolls will be minimized by water cooled panels installed in this area.

In addition to the basic continuous casting unit, this installation will include a water recirculation system, water treatment equipment, and an electrical substation.

4. The Hot Rolling Mills Area

a. Roll Side Shifter for Combination Mill

At present, when changing the combination mill from a two-high to a four-high and vice versa, the rolls must be pulled out of the housings on a roll sled, lifted from the sled individually, and the new rolls replaced in the same manner by the mill crane. This operation requires about an hour. The proposed installation of a roll side shifter would make it possible to set the new rolls at any convenient time. The average time for changing the mill from four-high to two-high then would be an estimated 13 minutes, and from two-high to four-high it would take 16 minutes. This decrease in roll changing time would add to rolling time on

the Combination Mill - and consequently to total hot mill production.

The cost of installing this roll side shifter at this time is minimized by the fact that its foundation is already in place, having been included in the design for the original plant.

b. Auxiliary Fuel Oil System

At present, the slab furnace is heated by coke oven gas only. Coke oven gas is in short supply, however and will be needed even more urgently by other consuming units upon completion of this expansion program. Also, during the blast furnace reline, coke oven gas will not be available for slab heating. It is therefore proposed to provide the slab heating furnace with a system which will enable the operators to burn either fuel oil or coke gas.

The oil loop supplying the slab heating furnace will be extended to serve the soaking pits. At present they are burning mixed coke oven and blast furnace gas. This will be continued, but fuel oil could be used at the soaking pits in emergency situations.

5. The Cold Rolling Mill Area

a. Side Trimmer for the Pickling Line

Hot rolled material to be reduced to thin gauges on a cold mill must have the edges trimmed to avoid tearing during cold reduction. Such tearing may become severe enough to cause a coil break and, in turn, cobbles and possible damage to the cold rolling mill. Installation of a side trimmer is proposed for the pickling line for trimming the edges of hot rolled pickled coils. This will be done without adding any time to the pickling operation.

At present the edge trimming of coils to be rolled into light gauge cold rolled product such as tin plate is being done on the 42 inch

slitter. This is a costly operation, and will no longer be feasible when production volumes increase. The slitter at the pickling line will therefore release the 42 inch slitter to augment the production of skelp.

In conjunction with this side trimmer, a scrap chopper and conveyor will be supplied to handle the scrap efficiently.

b. Annealing Furnaces

The existing annealing equipment consists of 15 furnaces and 45 bases. Each furnace has an annealing rate of about 1.4 tons per hour, or a theoretical maximum of 184,000 tons per year in total. Annealing requirements are expected to surpass this level by 1970, and it therefore is proposed that three additional furnaces be installed. This would bring the ratio of bases to furnaces down to 2.5, which has been found ample.

c. Annealing Crane Modifications

Two 18.2 ton capacity cranes service the annealing building. Each crane has only one main hoist. When throughput is stepped up, it will be necessary to add auxiliary hoists on these annealing cranes to handle the coil convector plates, while the main hoists are handling the coils.

d. Building Extensions

Three bays are to be added to the south end of the cold mill building in order to provide additional space for storage of finished and smi-finished coils and sheets. This is considered a bare minimum addition for this purpose, but it should suffice for the immediate future.

One bay will be added to the south end of the annealing building to provide coil storage space and to facilitate crane servicing of the temper mill.

It is also proposed that the crane rails in the slab yard be extended one bay beyond the north end of the building to insure con-

tinuous loading of the slab reheat furnace.

6. General Facilities

a. Auxiliary Fuel Oil System

This proposed addition was discussed above under the heading of Hot Rolling Mill Area. In this connection, it is intended that the oil company supplying the oil would provide a bulk oil storage tank which would be located within the existing dike. The purchased equipment would include a day storage tank, pumping equipment, suction heater, piping, burners for the slab heating furnace, instrumentation and controls.

b. Controls for blast furnace gas system

This change involves incorporating a time delay switch with the pressure switch controlling the flow of blast furnace gas to the boilers. This item, plus the recently installed electric operators for the burner cocks and automatic bleeder, will permit maximum utilization of blast furnace gas at the boilers.

c. Salt Water Chlorination

Marine growth has become a problem in the strainers and condensers in the power house. This will be cured by chlorinating the salt water, and equipment will be provided so that this can be done on either a periodic or continuous basis as required.

d. Service Water Treatment

Raw service water from the Guluc River must be treated chemically to reduce its turbidity and scaling potential. In order to obtain the maximum softening possible with cold lime, the batch slaking of lime is to be replaced with a continuous slaker having gravimetric feed and grit removal.

It will also be necessary to feed sulfuric acid into the effluent from the clarifier at all times, and equipment will be installed to do this.

e. Recirculating Water at the BOF

The present clarifier taking water from the Guluc River will not be able to meet service water requirements when production is stepped up as a result of this program, unless provision is made for recirculation of service water at some point in the plant. The best place to do this is at the BOF shop. Therefore a cooling tower, pumps, piping and controls will be provided to recirculate the cooling water for the lance, vessel hood, and the shell of the primary venturi.

f. Maintenance Equipment

It had originally been expected that a considerable amount of maintenance work requiring heavy machine shop facilities could be done by outside shops. This has not proven feasible due to the limited amount and slow development of such facilities. Eregli maintenance personnel have prepared a list of equipment items which will be required as maintenance activity increases in line with the increased production facilities. Purchase of items will be made as the need is demonstrated. Typical of the items on this list are heat treating equipment, grinding machines, milling machines, boring machines, and lathes.

g. Rolling Stock and Mobile Equipment

The increased production which this expansion program will make possible will involve the handling of increased quantities of raw materials, products in process, and finished products.

Much of the existing mobile equipment is a carry-over from construction days, and is not always the appropriate type to do more than a bare minimum job in its present application. Railroad rolling stock also will have to be supplemented as production increases.

In this area also a list of rolling stock and mobile equipment has been prepared, and items will be purchased as the need is demonstrated.

h. Tramp Iron Magnet and Belt Scale

This is a small item in the program, but an important one. Occasionally stray iron or steel parts get into the coal or limestone, and are a hazard to the crushing equipment. Magnets to be placed in the conveyor lines will remove such items. A belt scale for the coal conveyor will be installed in order to eliminate errors in recording the amount of coal received.

7. Main Electrical Substation and Distribution

Expanded operations will require additional power, distribution, and switching. No additional generating facilities are proposed at this time, and Eregli will depend on Etibank power to a greater extent than at present. The main substation will be equipped to handle the increased loan by the installation of two 150-DH-1000, 1200 amperes, 13.8 KV, feeder circuit breakers.

Additional substations will be provided in conjunction with the installation of both the new oxygen plant and the continuous casting plant.

8. Spares for Start-Up and Operations

Eregli facilities, both existing and as proposed in this program, are of the most modern type. They are also furnished from distant sources, and in most cases cannot be serviced by parts available

locally. This makes it necessary to have on hand a relatively large inventory of spare parts in order to assure continuity of operations.

The supplier of each item of equipment included in this program will be requested to submit a list of recommended spare parts, and purchases thereof will be made as warranted.

9. Construction Equipment Spares

During a construction project such as the one proposed here, a considerable amount of spare parts, tools, and special equipment will be required. The need is especially apparent in this case since much of the construction equipment to be used will be drawn from Eregli's stock of units still on hand since the original plant was built.

C. Estimated Capital Expenditures

Table 6 on page 48 shows the items included in this proposed capital program, and the estimated costs for each. These estimates are shown both for the dollar cost of the purchases and the portion of the lira costs allocated to each. In the case of the oxygen plant the estimated cost of purchasing the plant in Europe also is shown.

The amounts shown in the "U.S. Dollar Purchases" column represent the estimated costs of purchases from vendors in the United States. It is planned that all machinery, equipment, materials and services from the United States, and the oxygen plant from Europe, will be purchased directly for Erdemir's account. The amounts shown here are estimates of the costs of such purchases, including inland freight and packing in preparation for ocean shipment. The estimated cost of ocean freight and insurance for all of the items in the program is shown as a separate item, as is the estimated dollar cost Erdemir will incur in connection with carrying out this purchasing function.

The amounts noted as being "contingencies" fall into three categories. First is the item for scrap charging equipment. The amount shown here represents the estimate of the cost of the equipment described in the previous section to be installed in the BOF shop scrap handling area. The reason that this item is shown under "contingencies" is because further consideration is still being given to an alternative method of handling and charging this scrap.

The item "Provision for Escalation, etc." is included for two purposes. First is the stated one of escalation. These cost estimates were prepared

in the latter part of 1966, and since the actual purchases will be made over a period of two or more years it is clearly prudent to anticipate that the increasing trend of costs will continue during this time. The balance of this provision is included to cover such things as changes in design or in scope that may be necessary or desirable as the program is being implemented.

The third item under "Contingencies" is a provision to cover the estimated cost of a survey of Erdemir's requirements and plans beyond the expansion program herein proposed.

The last item in the "U.S. Dollar Purchases" column is the estimated cost of engaging a contractor to serve as "Project Manager", which would entail doing the engineering, purchasing, supervision of construction and start-up.

The second column on the tabulation of estimated capital expenditures shows the cost of the oxygen plant to be purchased in Europe. This unit is expected to be essentially a duplicate of the present Air Liquide plant. The amount shown includes spare parts and transportation from Europe to Eregli. It should be noted that some $485 thousand in U.S. Dollar Purchases also are involved in the oxygen plant, with the largest part of this being for the electrical substation required in this installation.

The third column on the tabulation shows the dollar equivalent of estimated lira costs which would be incurred in Turkey in connection with this program, such as all labor costs, purchases of locally furnished materials, providing construction equipment and tools, and office and housing facilities for the contractor's personnel. There is also an amount shown in the lira cost column for "Project Management", which is based on the anticipation of lira costs to be incurred by the contractor's personnel in Turkey.

A relatively large provision for "escalation, etc." is shown in the lira cost column, because of the inherent difficulties involved in estimating labor costs and productivity in a situation like this one.

Table 6

EREGLI EXPANSION PROGRAM
ESTIMATED COSTS - IN THOUSANDS OF U.S. DOLLARS

	U.S. Dollar Purchases	European Purchases	Lira Costs in Turkey	Total
Estimated Direct Costs For Erdemir's Account				
Hot Metal Production Facilities :				
Fuel oil injection	$ 68		$ 38	$ 106
High top pressure	180		40	220
Blast furnace reline	289		194	483
Hearth expansion	587		237	824
Steel Production Facilities :				
Oxygen plant	485	2,473	939	3,897
Lime kiln alterations	90		66	156
Steel ladles	46		8	54
Scrap preparation equipment	35		16	51
Scrap charging equipment (see contingency below)				
Continuous Casting Facilities	4,631		1,229	5,860
Rolling mill facilities :				
Combination mill roll side shifter	247		31	278
Side trimmer-pickling line	220		92	312
Auxiliary hoists-annealing	14		1	15
Additional annealing furnaces	75		7	82
Building extensions	409		343	752
General Facilities :				
Auxiliary fuel oil system	184		86	270
Blast furnace gas system controls	2		1	3
Salt water chlorination	42		46	88
Service water treatment	74		56	130
Recirculating water - BOF	155		106	261
Maintenance equipment	301		59	360
Materials Handling :				
Rolling stock & mobile equip.	1,103		40	1,143
Tramp iron magnets & belt scale	21		9	30
Main substation & distribution	302		46	348
Spare operating parts	1,000		30	1,030
Construction equipment spares	308		-	308
Ocean freight & insurance	1,000		-	1,000
Erdemir Purchasing Mission	130			100
Sub-Total	$11,968	$2,473	$3,720	$18,161
Contingencies :				
Scrap charging equipment	482	-	155	637
Provision for escalation, etc.	2,000	327	1,125	3,452
Provision for steel survey	200	-	-	200
Sub-Total	$14,650	$2,800	$5,000	$22,450
Project Management: Engineering, purchasing, supervision of construction and start-up	3,700		50	3,750
Totals	$18,350	$2,800	$5,050	$26,200

VI. Financial Performance

As mentioned in the Summary Justification section, the most basic reason why Erdemir is urging the immediate undertaking of this proposed expansion program is because it will improve the company's financial performance very substantially.

Projected financial statements are presented at the end of this section, including Earnings Statements, Cash Flow Statements, and Balance Sheets, as well as several other pertinent tabulations. The assumptions on which these statements are based are presented in the next part of this section, and comments and observations then follow.

A. Underlying Assumptions

1. Sales

Projected sales of flat rolled products are based on Armco's "low" market projection. Pig iron is produced and sold through 1970. None is made or sold in 1971, since all available hot metal will be used in making steel to meet flat product requirements with the balance going into continuously cast billets. Billet sales in 1967, 1968, and 1969 are Eregli blooms which are rolled into billets by Karabuk on a toll basis. In 1970 and 1971 billets are from the new continuous casting plant. All selling prices are held at the present levels throughout the projection period. This assumption may be unrealistic since the costs of raw material and labor have already risen sharply in the first quarter of 1967, and certainly will continue to rise during the next five years.

2. Production

These projections are based on the assumption that the pro-

posed expansion program will be started by July 1, 1967 and completed by December 31, 1969. "Shakedown" of the new and altered facilities would then be completed in 1970, and the first full year of expanded operations would be 1971. Since it is impossible to predict just when the blast furnace will have to be relined, these projections do not reflect a blast furnace shut-down period.

Flat product production quantities were projected in line with sales requirements, except for 1967 when sales of 10,000 tons out of finished inventories are anticipated. As mentioned earlier, billet production in 1971 is determined by hot metal availability, which is conservatively projected at 660,000 metric tons. This represents the annual output of the modified blast furnace, assuming that approximately 700,000 metric tons of sized imported iron ore will be purchased to augment purchases of 600,000 tons of Turkish ore. This also assumes that about 15 percent of the local ore will be screened and set aside as fines, which then might be sold at 50 TL. per ton. Furthermore, this blast furnace tonnage projection is predicated on continuing to make coke from locally sourced coal of the quality now being received. 1971 production amounts of all principal plant units were presented in Table 5 on page 32 . Anticipated yields for each unit in the production sequence are in line with those set forth in the Armco report.

Production material costs, contrary to the conservative decision to hold selling prices constant in this projection, are projected to increase 5 percent per year for all purchases in Turkey, and 3½ percent per year for all imported materials, including iron ore. The base point for these projected cost increases was the

present cost level, after already recognizing several known increases such as the recent 22.72 TL. per ton increase in the price of coal. The present price of imported iron ore of the recommended quality has been established at about 151 TL. per ton, delivered at Eregli.

Projected production labor costs also reflect known and anticipated wage rate increases. Based on the recently concluded union negotiations, wages in 1967 are projected to exceed the 1966 level by 20 percent. This is then followed by a 15 percent further increase in 1968. No increase is anticipated in 1969, but 1970 reflects a 10 percent rise followed by another 10 percent increase in 1971. Some offset to the substantial cost increases projected in wage rates is provided by the assumption that progress will be made toward attaining the Armco recommendation of reducing the plant force by 1,100. It has been assumed that 15 percent of this goal will be achieved in 1967, another 25 percent in 1968, and 20 percent more in 1969. The attainment of 60 percent of the recommended reduction is all that is reflected in these projections. Every effort will be made to make even further reductions, of course, but it is felt that since Armco's figures were based on Middletown, Ohio, conditions a 60 percent achievement would be a reasonably good showing for this immediate period when training is still underway and high turnover of personnel is still a problem.

3. Other Expenses

The reduction of Selling and General & Administrative in 1968 and 1969 reflects the phased moving of most of the Ankara offices to Eregli. This expense category then increases a bit in 1970 and 1971 reflecting normally anticipated raises.

Depreciation charges rise each year reflecting the addition of the proposed capital expenditures to the gross property accounts. It is assumed that the policy of depreciating all fixed assets at a composite rate of 3½ percent per year will be continued through this

projection period.

Organization and pre-operating expenses are being amortized over a five-year period beginning in 1966, and thus no such charge appears in the 1971 Earnings Statement.

The costs of expatriates, shown as "Management Contract and ICSI", are projected to continue at the 1967 level throughout this projection period. It is assumed that continuing assistance of this type will be necessary. Also, some tapering off in the number of ICSI people at Eregli will probably occur during this period, but the costs are held constant here as a conservative measure.

4. Debt Service

The accompanying financial statements reflect debt service figures on the basis presently established for each of the existing loans. In other words, no refinancing measures are incorporated in these figures. This is for two reasons. First, is because the purpose of this paper is to appraise the proposed expansion program, and in this connection it would not be proper to allow the means or extensiveness of any refinancing to color the financial impact of the expansion.

The second reason that no refinancing is incorporated herein is because the results thus show clearly how very necessary a refinancing is. Certainly the expansion program contributes very substantially to the company's financial performance, but in the meantime a way must be found to make it possible for the company to survive while the expansion and other steps are being implemented. The telling point is that the expansion promises to put Eregli on a "going concern" basis, and to achieve this state it is well worth taking the steps, including refinancing, which are necessary to get it there.

As we understand it a number of refinancing measures are being

reviewed and considered by all concerned. Suffice it here to say that Erdemir recognizes that an appropriate refinancing plan must be adopted as an integral part of the steps being taken to expand the Eregli plant and make this company able to achieve its basic objectives, and it sincerely hopes that the parties to whom this report is directed also recognize this basic fact and take favorable action to that end very soon.

B. The Earnings Statements

The detailed Earnings Statements projected for the years 1967 through 1971 appear as Table 7 at the end of this section. The key elements are summarized in the following tabulation:

	1967	1968	1969	1970	1971
	(In thousands of metric tons)				
Sales Quantities					
Flat Products	250	270	300	384	420
Billets	57	60	60	165	261
Pig Iron	80	80	80	103	-
	(In millions of TL.)				
Sales Revenues	692	736	799	1,132	1,242
Cost of Sales	502	554	594	711	773
Plant Profit before Depr.	190	182	205	421	469
Other Expenses (incl. Depr.)	132	135	141	143	133
Profit before interest	58	47	64	278	336
Scheduled interest charge	140	132	131	128	120
	(82)	(85)	(67)	150	216

Sales quantities and revenues are expected to rise at about 11 percent per year, except for 1970 which benefits from a larger surge in flat product sales as the expanded facilities come "on stream". That year also benefits from having both pig iron and billets produced for sale, whereas the prior year (1969) was limited to such billet sales as could be rerolled from Eregli blooms at Karabuk. Attention again is called to the fact that these figures do not reflect a shut-down period for relining the blast furnace, which is impossible to schedule accurately at this time.

A look at the relative trends of revenues and costs shows the effect of holding projected selling prices while reflecting anticipated cost increases. Thus the profit at the plant level in 1968 is the same as in 1967 in spite of the higher volume of sales. By 1969 the combination of added volume and further force reductions enable the ratio of plant profits to sales to hold at about the 27 percent level shown for 1968. Then in 1970 and 1971 the percent return on sales at the plant profit level rises into the high 30's as the full benefits of much greater throughputs and maximum utilization of imported iron ore are realized.

The measure of the Earnings Statement benefits created by the expansion program is clearly seen by comparing projected 1971 results with those anticipated for 1968. The 1971 figures represent the first full year of the expanded operations, while the 1968 level of production and sales is essentially the same as the "design capacity" of the original plant.

	1968	1971	Difference
		(In millions of TL.)	
Sales Revenues	736	1,242	+506
Plant Profit	182	469	+287
Profit before Interest	47	336	+289

This comparison indicates that the pre-interest incremental profit attributable to the expansion program is 289 million lira or about $32 million per year at this level of operations. This represents a more than 100 percent incremental return on the investment required for this program.

Turning to the matter of absolute results rather than incremental, these projections show that operations with the expanded facilities would put the company's Earnings Statement well into the black even after recognizing all presently scheduled interest charges. As has been pointed out, however, the net earnings - after presently scheduled interest

Table 7

ERDEMIR PROJECTED EARNINGS STATEMENTS
(BASED ON EXPANSION PROGRAM - BUT NO REFINANCING)
(In millions of TL)

	1967	1968	1969	1970	1971
Sales	693	736	799	1,132	1,242
Cost of Sales	502	554	594	711	773
Plant Profit before Depreciation	190	182	205	421	469
Depreciation	90	94	100	101	101
Profit before other expenses	100	88	105	320	368
Other expenses					
Selling and General & Administrative	16	14	14	15	16
Social Services - Net	3	4	4	4	4
Amortization of Organization & Pre-Operating Expenses	11	11	11	11	-
Management Contract & ICSI	13	13	13	13	13
Other (Revenues) - Net	(2)	(2)	(2)	(2)	(2)
Total Other Expenses	41	40	40	41	31
Profit before Interest	58	47	64	278	336
Interest & Financial Charges	140	132	131	128	120
Net Profit (Loss)	(82)	(85)	(67)	150	216

Table 8

ERDEMIR PROJECTED SALES QUANTITIES
(BASED ON EXPANSION PROGRAM)
(In thousands of metric tons)

PRODUCT	1967	1968	1969	1970	1971
TOTAL FLAT STEEL PRODUCTS	250,000	270,000	300,000	384,000	419,500
PRIMARY FLAT STEEL PRODUCTS	219,000	246,700	282,000	361,850	395,000
Hot Rolled Sheets-Unpickled	21,700	20,300	44,688	54,300	59,730
Hot Rolled Sheets-Pickled	10,300	14,100	21,523	27,000	29,770
Plates	26,000	36,000	31,795	36,800	40,000
Skelp	80,000	89,500	90,720	105,000	112,000
Cold Rolled Sheet	49,000	54,000	57,850	98,250	109,500
Tin Plate	32,000	32,800	35,424	40,500	44,000
SECONDARY FLAT STEEL PRODUCTS	31,000	23,300	18,000	22,150	24,500
Hot Rolled Sheets-Unpickled	3,300	3,300	4,234	5,100	5,670
Hot Rolled Sheets-Pickled	5,700	2,300	2,035	2,600	2,830
Plates	5,000	4,000	2,765	3,200	3,500
Skelp	-	500	-	-	-
Cold Rolled Sheets	9,000	6,000	5,030	6,750	7,500
Tin Plate	8,000	7,200	3,936	4,500	5,000
Billets	57,000	60,000	60,000	165,000	261,500
Pig Iron	80,000	80,000	80,000	103,340	-
Coke	15,000	-	-	-	-
Coke Breeze	25,000	40,000	40,000	51,800	51,800
Benzol	2,000	2,670	2,970	3,207	3,207
M. Benzol	500	670	750	810	810
Toluol	250	325	360	390	390
Xylol	100	130	145	155	155
Solvent Naphtha	100	130	145	155	155
Naphthaline	400	530	590	637	637
Tar	8,000	9,000	10,000	11,000	11,000
Ore Fines	75,248	60,000	90,000	64,000	90,000

Table 9

SALES PRICES
ALL YEARS: 1967 - 1971

PRODUCT	TL. PER METRIC TON
PRIMARY	
Hot Rolled Sheets - Unpickled	1,946.97
Hot Rolled Sheets - Pickled	2,057.13
Plate	2,009.21
Skelp	1,775.05
Cold Rolled Sheets	2,390.92
Tin Plate	3,277.00
SECONDARY	
Hot Rolled Sheets - Unpickled	1,601.01
Hot Rolled Sheets - Pickled	1,784.86
Plate	1,510.06
Skelp	1,650.00
Cold Rolled Sheets	2,193.78
Tin Plate	2,837.60
Billets	1,208.33
Pig Iron	833.33
Coke	290.00
Coke Breeze	65.00
Benzol	636.00
M. Benzol	420.00
Toluol	1,441.00
Xylol	1,780.00
Solvent Naphta	1,780.00
Naphthaline	500.00
Tar	166.66
Ore Fines	50.00

charges - will be very unsatisfactory during the intervening years if nothing is done in the way of refinancing. Actually the company will be in a state of bankruptcy sometime during 1967-1968 if debt service is required to be paid in accordance with the presently established schedule.

C. The Cash Flow Statements

Detailed Cash Flow Statements as projected for 1967 through 1971 are attached as Table10. The key elements are summarized in the following tabulation:

	1967	1968	1969	1970	1971
	(In millions of TL.)				
Sources	747	851	923	1,149	1,257
Requirements	552	690	749	761	835
Cash Generated for Debt Service	194	161	174	388	422
Debt Service on:					
Hard Currency & Bank Loans	130	25	33	28	28
Sub-Total Cash Generated	64	104	138	356	391
Debt Service on:					
Present Lira Loans	123	254	203	203	200
New Expansion Loans	1	6	13	16	29
Net Cash Generated	(60)	(154)	(75)	143	166
Cumulative	(60)	(214)	(289)	(146)	20

The above "Sourced" figures for 1967, 1968 and 1969 include the loan drawdowns which it is assumed will be made available for the expansion program, as well as the additional loan earmarked for continuing ICSI commitments. These amounts included in "Sources" are matched by the projected expansion capital expenditures and ICSI costs included in the "Requirements" figures.

The pertinent figure shown here, insofar as appraising the proposed program is concerned, is the "Cash Generated for Debt Service". Looking

at figures at this level avoids distorting the results of operations with the way debt service is handled. The relatively high cash flow figure estimated for 1967, as compared to the subsequent two years, is largely attributable to the steps being taken to reduce invontories, including the sale of 10,000 tons of flat rolled steel out of finished product stocks. The very substantial Cash Flow increases projected for 1970 and 1971 reflect the sharply higher revenue from increased output of the expanded plant, with a much lower incremental increase in requirements. This is because the added production can be accomplished with the only appreciable added costs being for the required raw materials and supplies.

Comments on the incremental Cash Flow effect of the expansion program were presented in the Summary Justification section of this report. The figures presented there showed that Cash Flow before debt service for 1971 (the first full year of expanded operations) exceeded the 1968 level (when production is essentially at the "design capacity" of the present plant) by 261 million TL. To reiterate, this represents a less than one-year "pay-back period" on the estimated capital investment required to implement the expansion.

Looking at the Cash Flow Statements on an absolute basis discloses that even with the presently scheduled debt service payments the cumulative Cash Flow will just break into the black at the end of 1971. It should be emphasized by repeating that the presentation of these projections on an "as is" debt service basis points up very clearly that something has to be done in the way of a refinancing to tide the company over the next three years or so.

As mentioned, the debt service figures used here are based on the presently established loan agreements, as amended in certain cases. Some additional explanations are in order. The 1967 figures anticipate that

all of the approximately 60 million lira in local bank loans will be paid off by July, and as of April this balance had been reduced to about 10 million lira. Furthermore, these projections also assume that the Cooley Loan principal payments which were passed in 1966, as well as those scheduled for 1967, will all be paid in 1967. This of course causes the net cash flow figure after all debt service to dip into the red this year.

With respect to the construction and housing loans from the Government of Turkey, these figures are based on a repayment schedule starting at the time the AID Loan A repayments start, even though this intended change has not yet been fully documented.

One final comment with respect to these projected debt service payments has to do with both the AID Loan A and GOT interest payments. The amount shown in 1968 includes a full year's interest with respect to 1967 which is scheduled to be paid on January 1, 1968, and it should be recognized that the cash for such payments would have to be generated in some way in 1967. This of course affects the relative amounts reported for 1967 and 1968, but it does not change the basically untenable cash position of the company throughout the next three years until the expansion program has been completed.

Table 10

ERDEMIR PROJECTED CASH FLOW STATEMENTS
(BASED ON EXPANSION PROGRAM - BUT NO REFINANCING)
(In millions of TL.)

	1967	1968	1969	1970	1971
SOURCES					
Sales Revenues	693	736	799	1,132	1,242
Social Facilities Revenues	3	4	5	5	5
Other Revenues	2	2	2	2	2
Stock Sales	7	-	-	-	-
AID B Loan & New ICSI Loan	10	10	10	10	8
AID Expansion Loan	18	72	76	-	-
GOT Expansion Loan	9	9	9	-	-
European Expansion Credits	5	18	22	-	-
Total Sources	747	851	923	1,149	1,257
REQUIREMENTS					
Material Purchases	347	415	468	587	650
Other Plant Costs	95	104	101	114	123
Billet Toll & Transportation	11	12	13	-	-
Social Facilities Cost	4	5	5	6	6
Selling and General & Administrative	16	14	14	15	16
Management Contract & ICSI	13	13	13	13	13
Dividend Payments	12	7	7	7	7
Normal Capital Expenditures	22	20	20	20	20
Expansion Capital Expenditures	32	99	107	-	-
Total Requirements	552	690	749	761	835
CASH GENERATED FOR DEBT SERVICE	194	161	174	388	422
DEBT SERVICE - PER PRESENT SCHEDULES					
Hard Currency Debt Service:					
Principal Payments	39	32	13	9	9
Interest Payments	27	23	20	19	19
Total Hard Currency Payments	66	55	33	28	28
Payment of Local Bank Loans:					
Principal	60	-	-	-	-
Interest (Estimated)	4	-	-	-	-
Total Bank Loan Payments	64	-	-	-	-
Lira Loan Debt Service:					
Principal	113	85	101	106	111
Interest	10	169	102	97	89
Total Lira Loan Payments	123	254	203	203	200
New Expansion Debt Service:					
Principal	-	1	2	2	15
Interest	1	5	11	14	14
Total Expansion Loan Payments	1	6	13	16	29
TOTAL DEBT SERVICE	254	314	248	246	257
CASH FLOW AFTER DEBT SERVICE	(60)	(154)	(75)	143	166

D. The Balance Sheets

Table 11 on page 65 presents projected balance sheets through 1971. These figures are based on the assumption that no refinancing will be implemented, and as a result the cash figure appears as a negative amount. This is obviously an impossible situation, but it is, as mentioned, one way of emphasizing the point that something must be done.

For purposes of these projections it also has been assumed that accounts receivable and accounts payable would hold at the December 31, 1966 level throughout this five-year period. It is recognized that increased business volume might cause some up trend in these accounts, but since they are essentially offsetting elements, and also hard to predict accurately, this was felt to be a reasonable approach.

The projected inventories shown on the balance sheets are detailed in Table 12 on page 66 . Some substantial reductions are anticipated, though it must be noted that these projections do not anticipate as great an overall inventory reduction as was recommended in the Armco report. As in the case of the force reductions, every effort will be made to keep inventories down to a minimum level, but the figures presented in these projections represent what Erdemir believes are reasonably attainable levels during the period under the circumstances.

For example, projected iron ore inventories are inflated by some 18 million TL. for ore in stock at Samsun and at the railheads. In the absence of information to the contrary, it is assumed that this factor will accompany continued domestic ore purchases.

Other areas where inventory reductions are anticipated, but where the total levels will still remain relatively high, are maintenance and operating supplies, as well as spare parts and components. In both of these cases, the fact the Eregli is a long way from the sources of

the items, and the somewhat cumbersome procedures involved in purchasing and importing such things, make it absolutely essential that adequate inventories be kept on hand. The consequence of course is that such stocks at a plant such as Eregli will always be higher than for a similar plant located in the United States or even in Europe.

One other area where significant reductions appear on the accompanying table is in finished products. Here, as mentioned, flat rolled product stocks on hand are expected to be reduced by 10,000 metric tons in 1967. Pig iron stocks are also expected to be reduced - by 15,000 tons in 1967 and by another 20,000 tons in 1968.

On the other hand, imported ore inventories are expected to build up as the proportion of imported ore to total requirements increases. Also, as an effect of this, it is projected that stocks of domestic ore at Eregli will be reduced in 1970, partly because this is the year when most of the long-term ore purchase contracts phase out, and partly because by then the larger stocks of imported ore on hand as well as the more certain and ready availability of imported ore at this time of year (these are projections of year-end inventories) will relieve some of the necessity of keeping as much domestic ore on hand.

Taken in total, inventory reductions do represent a sizable source of cash during the projection period. For example, 1967 shows a 19 million TL. reduction, followed by a 21 million TL. reduction in 1968. The two

subsequent years each show reductions of about 10 million TL. For the five-year projection period, then, inventory reductions represent a source of almost 90 million TL. for Erdemir.

The gross property, plant and equipment account reflects "normal" capital expenditures of about 20 million TL. per year, as well as the cost of the proposed expansion program.

Loans with respect to the proposed expansion also are reflected in the Long Term Debt section of the Balance Sheets. The sources, amounts, and terms were assumed as follows:

AID Dollar Loan	-	165 Million TL.
GOT Lira Loan	-	45 Million TL.

Both with interest at 6 percent, paid currently, and principal to be repaid in 16 equal annual installments, starting four years after the first drawdown.

European Credits - 25 million TL.

Interest at 8 percent, paid currently, and principal paid as follows: 10 percent down-payment when order is placed, 10 percent of value of equipment when delivered and 80 percent in 20 equal semi-annual installments.

All present debt elements were included in these projected balance sheets on the presently established bases.

Table 11

ERDEMIR PROJECTED BALANCE SHEETS
(BASED ON EXPANSION PROGRAM - BUT NO REFINANCING)
(In millions of TL.)

	Dec. 31 1966	Dec. 31 1967	Dec. 31 1968	Dec. 31 1969	Dec. 31 1970	Dec. 31 1971
ASSETS						
Current Assets:						
Cash	11	(49)	(202)	(277)	(134)	33
Accounts Receivable	41	41	41	41	41	41
Inventories	420	371	350	340	331	333
Prepaid Items	37	37	37	37	37	37
Total Current Assets	509	401	226	141	276	445
Deferred Charges and Other Assets - Net	56	45	34	22	11	11
Property Plant & Equipment	2,465	2,518	2,637	2,761	2,781	2,801
Less: Depreciation	106	197	291	391	492	593
Net Property, Plant & Equipment	2,358	2,322	2,347	2,370	2,289	2,208
Total Assets	2,924	2,768	2,606	2,533	2,576	2,663
LIABILITIES & EQUITY						
Current Liabilities:						
Bank Loans	60	-	-	-	-	-
Accounts Payable	55	55	55	55	55	55
Debt Due in One Year	220	182	177	178	197	192
Other Current Liabilities	5	5	5	5	5	5
Total Current Liabilities	340	242	237	238	256	252
Long Term Debt	2,294	2,281	2,207	2,203	2,094	1,965
Less: Due in One Year	220	182	177	178	197	192
Net Long Term Debt	2,074	2,098	2,029	2,025	1,898	1,773
Reserves	5	9	13	18	24	29
Stockholders Equity:						
Capital stock	521	529	529	529	529	529
Earned Surplus	(16)	(98)	(183)	(250	(98)	120
Sub-Total	505	431	346	279	431	649
Less Dividends Paid	-	12	19	26	33	40
Total Equity	505	419	327	253	398	609
Total Liabilities & Equity	2,924	2,766	2,606	2,533	2,576	2,663

Table 12

ERDEMIR PROJECTED INVENTORIES
(In millions of TL.)

	Dec. 31 1966	Dec. 31 1967	Dec. 31 1968	Dec. 31 1969	Dec. 31 1970	Dec. 31 1971
Raw Materials						
Imported Ore	-	1	7	7	11	11
Domestic Ore at Eregli	30	30	25	25	13	14
at Samsun & Railheads	18	18	18	18	18	18
Ore Fines	4	-	-	-	-	-
Coal	11	11	13	13	13	14
Other Raw Materials	3	2	1	1	1	1
Sub-Total Raw Materials	66	63	64	64	55	57
Process Materials	20	20	20	20	20	20
Maintenance & Operating Supplies	59	56	50	45	45	45
Spare Parts & Components	53	50	45	40	40	40
Operating Supplies & Spare Parts in Transit	19	19	19	19	19	19
Ingot Molds & Stools	21	12	12	12	12	12
Products in Process	82	79	79	79	79	79
Finished Products	99	72	60	60	60	60
Total Inventories	420	371	350	340	331	333

E. Contribution of Continuously Cast Billets

It must be understood that the items included in this proposed expansion program comprise a single, minimum plan designed with the express intent of making Erdemir financially successful, while requiring as little in new capital investment as possible at this time. In other words, the various elements of the program are not all separable for purposes of appraising their individual financial contributions.

The one large part of the program that does lend itself to a separate analysis is the continuous casting plant. Even here, of course, the ramifications of including or excluding this particular unit embrace other things also. For example, if no continuous casting plant is installed, the steel production requirements would be lessened so that it might not be necessary to install the proposed scrap handling and charging additions in the BOF shop. Also, depending on the demand for pig iron, it may be that some part of the blast furnace modification program such as high top pressure could be eliminated. In any event, a rough estimate of the amount of reduction in this proposed capital expenditure program if continuous casting is not included is in the area of 9 million, including both dollar and lira costs.

With this in mind, attention is turned to the question of what the inclusion of continuous casting can contribute to the financial performance of Erdemir. The accompanying financial statements which have been discussed in an earlier section include the effect of producing and selling continuously cast billets. Projections have also been prepared showing performance in 1970 and 1971 on the basis of no billets, and these are shown in the attached Table 13 on page 69. By comparing the results, it is possible to get a clear indication of the incremental financial contribution of the investment in continuous casting.

The following summary tabulation presents such a comparison. These figures are presented on a basis before debt service, since here again it is the basic earning power of the proposed investment which is being appraised, and the type or amount of debt service would distort that particular appraisal. It should also be noted that the "without billets figures include the same flat product production and sales as the "with billets" figures, and furthermore the absence of steel production for billets in 1971 would make it possible to include some 100,000 metric tons of pig iron in that year's figures.

	1970	1971
	(In millions of TL)	
CASH FLOW BEFORE DEBT SERVICE		
With Billets	388	422
Without Billets	271	253
Difference	117	169
PROFITS BEFORE INTEREST		
With Billets	278	336
Without Billets	171	176
Difference	107	160

These figures indicate that the portion of 1971 cash flow (before debt service) which is attributable to continuously cast billets will be about double the amount of new capital investment related to this part of the installation. The same relationship is indicated for the ratio of profits (before interest) to investment. In other words, the indicated "pay back period" is about a half year and the incremental return on investment is 200 percent.

This analysis clearly shows that the proposed continuous casting installation will add so significantly to Eregli's cash flow and profit performance that there should be no question about the desirabil. of

Table 13

ERDEMIR PROJECTED EARNINGS AND CASH FLOW STATEMENTS
(BASED ON EXPANSION PROGRAM - EXCLUDING CONTINUOUSLY CAST BILLETS)
(In millions of TL.)

	1970	1971
EARNINGS STATEMENTS		
Sales	935	1,015
Cost of Sales	630	714
Plant Profit before Depreciation	305	301
Depreciation	92	93
Profit before Other Expenses	213	208
Other Expenses:		
Selling and General & Administrative	15	16
Social Services - Net	4	4
Amortization of Organization & Pre-Operating Expenses	11	-
Management Contract & ICSI	13	13
Other (Revenues) - Net	(2)	(2)
Total Other Expenses	41	31
Profit before Interest	171	176
CASH FLOW STATEMENTS		
Sources:		
Sales Revenues	935	1,015
Social Facilities Revenues	5	5
Other Revenues	2	2
AID B Loan & New ICSI Loan	10	8
Total Sources	951	1,030
Requirements:		
Material Purchases	506	592
Other Plant Costs	113	123
Social Facilities Costs	6	6
Selling and Gen'l & Admin.	15	16
Management Contract & ICSI	13	13
Dividend Payments	7	7
Normal Capital Expenditures	20	20
Total Requirements	680	777
Cash Generated for Debt Service	271	253

including this in the expansion program. This of course substantiates Armco's recommendations, even though that report did not contain a separate analysis of the incremental financial contribution of continuous casting.

VII. Further Planning for the Future

The proposed expansion program presented in this paper is a step in the long-range planning which is a necessary, continuing function for an enterprise such as Erdemir. Of course, as has been mentioned, this program has been designed on a minimum basis with the intention of getting the company's financial performance up to a satisfactory level. At the same time, consideration of the other basic objectives of this firm, and particularly the matter of meeting Turkey's flat product market requirements, 5 to 8 years from now brings out the point that plans for subsequent steps will have to be established even before the presently proposed program has been completed. Reference to the market projections shown on pages 20 through 23 makes this clear, and the immediacy of the problem would be sharpened if the more optimistic of these several projections should prove to be the most accurate.

It should be stressed that this proposed "minimum" expansion program is entirely compatible with subsequent steps which may evolve. In fact the present program, predicated on the concept of "rounding out" the inherent capabilities of the existing equipment, will still leave the way open for even more extensive utilization of some of the existing units. The subsequent steps, however, will in general be relatively major in scope and cost.

The area which will still have the most room for increased throughput of the present units is cold rolling and finishing. Depending

on the product mix, this production area could probably process upwards of 700,000 metric tons per year with some relatively minor additions such as more annealing capacity. This could even be increased to some 900,000 tons per year with such additions as a fifth stand to the present four-stand tandem cold rolling mill, and another temper mill. Going beyond this level of finished product output would of course get into the range of some very sizable investments, but this would be a fairly long way off as far as requirements of the cold rolling and finishing end of the mill are concerned.

Stepping back in the production sequence to the hot rolling mill area discloses an entirely different picture, as has been mentioned earlier. This area, while it includes several pieces of working equipment, must be considered as basically a single unit with respect to production planning and scheduling. Therefore to increase hot rolling capability much beyond the level to be achieved with the proposed expansion will require a much more major understanding than the addition of some auxiliary units.

The present hot rolling production facilities will be able to handle some 500,000 metric tons after this proposed "minimum" expansion. This will meet projected requirements through about 1972 or 1973 - based on the Armco "low" market projections of course. Subsequent additional capacity will entail going to a semi-continuous hot strip mill.

One feasible plan, which was the tentative long-range idea in mind when the plant was laid out, is to add five additional stands in line with the present reversing hot strip mill. This in effect would give Eregli a semi-continuous hot strip mill with the present stand serving as the roughing unit, followed by a five-stand hot finishing train. The combination mill would continue to roll ingots, as well as plates during

a limited part of its schedule. Such a plan as this obviously would cost a very substantial amount.

Another even more expensive possibility would be to stay with the present hot rolling mill lay-out comprised of the combination mill and the reversing hot strip mill, and to install a five or six stand hot rolling finishing train in another location at Eregli. Here too the reversing hot strip mill would serve as a roughing mill. This is essentially what Algoma Steel in Canada has done, having started with a combination mill and reversing hot strip mill arrangement very much like Eregli's.

Turning to the iron and steel making area also discloses that planning beyond the range of the present expansion program involves some very sizable investments. Here it again must be recalled that raw material qualities play a very large part in determining output. For example, the projected hot metal tonnage of 660,000 tons per year, with the modified blast furnace, is predicated on charging partly local ore, partly sized imported ore, and coke made from Turkish coal of the quality now being received. Improving the charge by going to an enriched burden such as imported pellets, or even all sized ore, would boost this

furnace's output. The coke problem would also have to be solved either by importing better coking coal or by adding some additional ovens.

The better the burden the longer the present furnace will be able to meet hot metal requirements, of course, but eventually Eregli is going to have to put in a second blast furnace and additional coke ovens. This could be necessary as soon as 1972 or 1973, depending on the raw material situation and whether or not Eregli takes on the responsibility of producing billets to meet full Turkish market requirements.

The next big step in the basic end of the plant would then be the installation of the third vessel in the BOF shop. The original lay-out makes full provision for the third converter, and additional auxiliaries such as another oxygen plant, an additional calcining plant, etc. would bring the BOF shop's production capability up to about 1,600,000 metric tons per year. As in all of these steps, the expansion of the BOF shop must be phased with the availability of hot metal on the one hand and the means of using the added raw steel production on the other.

It is possible that the installation of an electric furnace might be a feasible way of delaying for a short time the very sizable investments that would be required for a second blast furnace, additional coke ovens, and the third BOF vessel. Imported scrap could be melted to provide all or part of the steel to be cast into billets. Then when the third converter is installed, the electric furnace could be used for the production of specialty steels.

The foregoing comments are presented as an indication of the type of planning that is now being studied with a view toward determining just what steps should be mapped out following the presently proposed expansion program. This planning obviously must be underway, even before this "minimum" program has been completed, and it is Erdemir's intention to pursue/carry on with this very important function, since this company is

going to be in this business - and a key part of the Turkish economy for a long time to come. Reference is also made to the fact that the provision for a "steel survey" included in this proposed program is aimed at seeing that the necessary long-range planning for Erdemir is going ahead.