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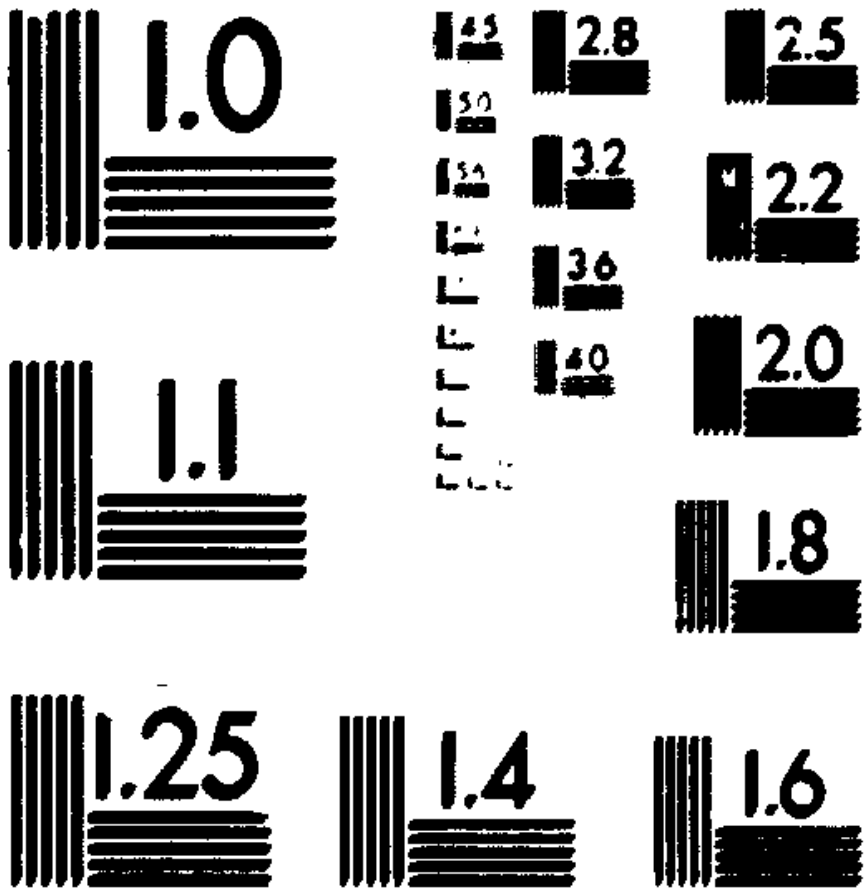

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Turkey.

DEVELOPMENT OF IRON AND STEEL INDUSTRY.

DP/TUR/76/038

[redacted]

TERMINAL REPORT.

Prepared for the Government of Turkey by the United Nations Industrial Development Organization as Executing Agency for the United Nations Development Programme

1984

This report has been cleared by the United Nations Industrial Development Organization (UNIDO)

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1) THE PROJECT

The project document for DP/TUR/76/038-Development of Iron and Steel Industry, was signed on 26 December 1978 with a total UNDP input of US $ 314,800 and a Government Cost-Sharing Contribution of US $ 342,000. The project budget as per the semi-final project revision "H" had a total UNDP input of US $ 300,000 (net). Field work started in September 1978 and completed in November 1982. The Turkish Iron and Steel Works functioned as Counterpart Agency. Working relationship between UNDP/UNIDO and the Counterpart had been established already through the project DP/TUR/77/014-Assistance to Karabük Steel Mill -which can be considered as a pilot phase of this project. The project had been included in UNDP's Second Country Programme for Turkey.

1.1) Objectives of the Project

1.1.1) Development Objectives

To make the Turkish economy less dependent on imports of iron and steel by assisting in the expansion of its iron ore, iron and steel production; to make it self-reliant with regard to preparation and implementation of expansion plans.

1.1.2) Immediate Objectives

(Listed below according to the Project Document; re-assessed during the course of the project: see 1.1.3)

1) To train manpower in the field of:

(i) preparing a plan for the iron and steel industry expansion of the country including raw materials supply plans;

(ii) preparing feasibility studies for individual projects.

2. To help the industry establish a design engineering capacity for implementation of investment projects.
3. To assist individual integrated steelworks:
   (i) developing their maintenance systems;
   (ii) improving operational skills and plant facilities.
4. To design and implement a training system, to enable the industry to cope with its growing manpower requirements.

1.1.3) Reassessment of Project's Objectives

The project was formulated and approved against the background of a prospective large-scale expansion of the iron and steel industry in Turkey. It was then projected that production of steel would be around 25-million tons per year in early 1990's as against 1977 production of some 2-million tonnes. In order to support the anticipated expansion, the project was to assist in the development of manpower for preparing master plans, feasibility studies and in establishing a design engineering capacity for implementation of new investment projects. Additionally, the project was also to assist existing steel plants to improve operational efficiency, develop maintenance systems and implement properly designed training systems.

Two major new investments were at an active planning stage at the time of the project commencement namely, Hasan Çelebi Pelletization Project and Sivas Integrated Steel Works. The project fulfilled its objective of assisting in the elaboration of the feasibility study for Hasan Çelebi Project and training the counterpart team in certain aspects of feasibility study

preparation (such as evaluation of test results of ore and pelletization) and general aspects to be considered in evaluation of feasibility for such investments. Assistance was also provided to the Feasibility Study Group for the Sivas Project through on-job training by international experts who evaluated the feasibility studies prepared by counterparts and also advised on organization of subsequent detailed engineering activity.

However, the economic conditions prevailing in the Country and the contraction in resources caused the Government to freeze the Sivas Steel Project; work on the Hasan Çelebi Project also slowed down considerably; it was also clear that massive new investments would not be forthcoming for some time. In the above altered environment, the accent was on improving productivity of existing investments. In mid-1981, by tripartite decision, the unspent project funds were funnelled into an integrated effort, through a reputed firm of international steel consultants (EC of U.S. Steel) for improving productivity of operations at Karabük Steel Works. Thus the objective of assisting individual steelworks which was, in a sense, a secondary objective as laid down in the original Project Document, assumed primacy.

In the above context, though the Project Document was not revised to reflect the above shift, any realistic evaluation must be based on the following targeted immediate objectives:

1. Improve productivity of operations at Karabük Iron and Steel Works through introduction of improved operation and maintenance practices.
2. Design of a training system based upon analysis of actual needs of Turkish Iron and Steel Works (Karabük and İskenderun) and introduction of the same.
3. Preparation of feasibility studies for Hasan Çelebi and Sivas Investment Projects.

2) OUTPUTS and ACTIVITIES

The project was intended to result in the development of a group of experienced and well trained engineers within Iron and Steel Works of Turkey capable of organizing, co-ordinating and implementing their own consultancy and engineering work without further external guidance. Such a result may have been regarded as the most important output of the project. At the same time, the following various direct and secondary outputs were intended to be produced through on-the-job training of these engineers and fellowship arrangements:

1) Reviewed and up-dated steel industry development plan,
   - 1.1) Assessment of the steel demand/supply relations in the future including product mix structure.
   - 1.2) Comprehensive raw materials supply and development plans.
   - 1.3) Strategies for expanding the steel production capacity.
2) Development of a consultancy/engineering organization with the capability to supervise, co-ordinate and conduct planning, engineering and construction of steel works, including;
   - (i) preparation of production flow sheets, plant layouts, main specification of equipment, electrical diagrams, etc.
   - (ii) preparation of tender specification and evaluation of bids for plant and equipment
   - (iii) instructions to equipment suppliers and approval of drawings submitted by suppliers
   - (iv) supervision of erection work.
   - 2.1) Assessment of local capacity for repair, maintenance and production of capital goods for the steel industry.
   - 2.2) Suggestions for the improved utilization of installed design engineering and production capacity of equipment and structurals for the steel industry.
   - 2.3) Technical assistance to Sivas project group in undertaking the feasibility study for the 4th integrated works.

2.4) Consulting in the field of maintenance and other problem areas in the existing steelworks (see output 5 below)

3) Development of the Hasan Çelebi Project (inconjunction with output 2.2. above)

3.1) Technical support for the Hasan Çelebi group, in charge with the subcontracting and follow-up of the feasibility study for a beneficiation plant.

3.2) Assessment of quality and quantity requirements of ore inputs at the national level and also in various steel plants.

3.3) Determination of required output of the Hasan Çelebi plant.

4) Improvement of maintenance and operation of existing works

4.1) Establishment of maintenance systems

4.2) Various trouble shooting missions in the field of

- blast furnace operations
- rolling mill and steel mill operations
- ore and coke preparation
- gas, water and general services

5) Assessment of existing training facilities for iron and steel personnel, both on vocational and university level.

However, corresponding to the re-formulation of the immediate objectives the outputs and activities also had to undergo changes. In deviation from the project document the realizable outputs were defined as follows:

1) Detailed analysis of current operational practice at Karabük Steelworks and specific recommendations for improvement for both short and medium term.
2) Introduction of short term recommendations including on-job training.
3) Analysis of training needs for both Karabük and İskenderun Steelworks and proposal for a training system.
4) Introduction of proposed training and development of trainers.
5) Assistance in evaluation of test results to help in establishing of feasibility of Hasan Çelebi project.

6) Assistance in evaluation of feasibility studies for Sivas project.

3) MAJOR PROJECT RESULTS

Output 1 and Output 2: As has been stated already under 1.1.3 on account of changed conditions, the accent of the project was directed towards improving productivity of existing investment, in this case Karabük Iron and Steel Works. The expertise for this purpose was provided by subcontract to USS Engineers and Consultants, Inc., a subsidiary of US Steel Corporation. The subcontractor fielded a team of high level consultants with active operational experience in the steel industry; the team was composed of specialists in the following departments which were determined to be the areas requiring urgent improvements: sinter, blast furnace, steel making, rolling mills, energy conservation and management, cost accounting and reporting and general organisation/management. Based on a detailed analysis of current operational practice the team made detailed recommendations for operational improvements in the following categories:

(a) improvements that could be immediately implemented with little or no investment,

(b) recommendations for the medium term calling for modest investments.

A particularly noteworthy feature of this output was the "hands-on" approach adopted by the subcontractor (as was specified in the terms of reference) and the training of counterparts along with the demonstration of improvements through joint working. Apart from introduction of better reporting and cost control methods, the short term technical recommendations are expected to result in a dollar saving of $ 4.5-million and increase a hot metal of 99,000 tonnes. When the medium term recommendations are put into effect, particularly in the matter of energy usage, overall savings are estimated at $ 14-million per year and further increase of hot metal of 150,000 tons/year.

Output 3 and Output 4 : A UNIDO expert (separate from the subcontractor stated above) carried out the activities leading to this output in two stages (split mission). In the first leg of the mission, the expert carried out a detailed analysis of the training needs both at Karabük and İskenderun and based thereon, drew up a comprehensive training programme for all categories of personnel. These recommendations are contained in the expert's technical reports 1, 2 and 3. As can be seen therefrom, apart from providing the framework for a system of an ongoing training activity for senior and middle management, supervisory personnel and operators, the expert identified the specific training needs (subjects and course content) immediately required to improve operations. He also provided details of the manner in which the existing training organisation needs strengthening taking into account the existing reality that new positions will not be sanctioned (i e. he suggested the manner in which persons from elsewhere in the plant could be transferred and trained).

In the second stage of the mission the expert conducted short training programmes of the executive-development category for middle management. Additionally, he conducted programmes for training teams of supervisors and selected senior operators to continue the training activity in their respective shops. A large number of such teams, under the guidance of the expert, worked out the methdology they would adopt for further training, the audio-visual material to be employed, the senior persons from whom they would obtain technical guidance, etc.

Output 5 : The assistance in evaluation of test results in the context of the feasibility study for the Hasan Çelebi project was provided by three short term experts (Ilmani, Dettmer and Jennings) fielded in 1979. Basically, the experts (a) advised on the type of tests to be carried out on iron ore samples and (b) evaluated the test results in order to establish the technical feasibility of Hasan Çelebi ores for pelletisation.

Output 6 : The assistance in evaluating the feasibilty study for Sivas project (which was prepared by local authorities) was provided by three short term experts (Sabela, Tochowicz and Jasienko) specialists in blast furnace and sinter, steel making and coke oven. Their main contribution was in providing substantive comments on the relevant sections of the feasibility study prepared including suggestions for modifications and revision. Additionally, they elaborated a framework for carrying out the subsequent detailed engineering activity for those sectio..

(Outputs 3, 4, 5 and 6 produced by individual experts fielded by UNIDO outside of the subcontract referred to for Outputs 1 and 2)

In retrospect, the concentration of project inputs towards improving the operations of existing steel plants as soon as it was clear that the background against which the basic thrust of the original objectives were set had been overtaken by subsequent events, served to preserve the utility and relevance of the project to the Turkish iron and steel industry.

4) FINDINGS and RECOMMENDATIONS

The major recommendations of the project fall into two broad categories: (a) those relating to the improvement of operation and maintenance at Karabük Iron and Steel Works, and (b) the training system for iron and steel personnel at Karabük and İskenderun.

(a) Recommendations pertaining to improvement of plant operations at Karabük were elaborated by the subcontractor working side by side with counterpart personnel (generally manager of specific plant departments) so as to provide on-job training and to enable the counterparts to benefit from the broad technical and practical background of subcontractor personnel. The subcontractor team was composed of a project leader and seven experts in different speciality areas. The recommendations made were in two categories: (i) short term actions involving little or no capital expenditure and (ii) intermediate term projects which call for major policy decisions and moderate investment. The short term actions recommended alone have been shown to result in an annual savings of $ 4,5-million increase of raw steel production by about 100,000 tons/year (current production about 550,000 tons/year). Many of the short term projects have been initiated (an in some cases completed) by subcontractor. The counterpart management is currently examining the more important intermediate term projects with a view to committing necessary investment.

The "hands-on" procedure specified for the subcontractor work has proved to be very useful in transferring know-how and in enthusing counterpart personnel towards the changes in practices recommended.

The following three tables summarize the major findings of the UEC team. Table 1 lists the major individual recommendations along with the anticipated benefits, current status and recommended further action. Table 2 lists the follow-up assistance in priority order as recommended by the UEC team. Table 3 lists those recommendations on which action had been taken prior to the final review meetings and details the benefits obtained as of that date.

SUMMARY OF UEC RECOMMENDATIONS, ANTICIPATED BENEFITS, AND ACTIONS REQUIRED

RECOMMENDATIONS	ANTICIPATED BENEFITS	STATUS AND ACTION REQUIRED
1. IMMEDIATE		
A. Initiate coke oven repair and rehabilitation program, beginning with correcting oven door leaks.	$4 to $5 million per year savings by increasing quantity and heating value of coke oven gas. Elimination of potential explosion hazard.	Karabuk needs immediate, expert assistance to inspect all coke oven equipment and develop a minimal-cost repair program: 2 men for 1 month.
2. SHORT-TERM		
A. Utilize existing coke crusher.	Reduce blast furnace coke rate by 15 kg/ton hot metal. Increase hot metal production by 3.7%.	Coke crusher placed in operation August 19, 1982. Sizing improved by end of September, but there was still too much +60 mm material. Crusher should be adjusted.
B. Begin production of superfluxed sinter.	Increased sinter strength and lower FeO, resulting in 19% increase in hot metal production and 153 kg/ton hot metal reduction in blast furnace coke rate.	Mazemag representative is needed to assist in starting new limestone crushing equipment.
C. Reduce coke ash by increased washing at mine.	Hot metal production will increase by 2.7% and coke rate will decrease by 2% for each 1% decrease in ash.	As a minimum the coal-producing company should be required to maintain a maximum coke ash content of 21.4% which was the actual in 1981.
D. Complete work on open hearth program for scrap handling.	This project is necessary to permit the increase in ingot production from 558,500 to 657,000 tons per year.	Building reinforcement to allow 2-crane operation is in progress and should be finished by October 31, 1982. Design of scrap burning layout should be finished in November 1982. Improved scrap burning equipment should be purchased based on recommendations of a manufacturer such as Union Carbide.
E. Reduce ingot transit time.	$294,000 annual savings by eliminating 15-minute hold time on semi-killed heats. $406,000 annual savings by 30-minute reduction in transit time from closer supervision.	The hold time has been eliminated and the pouring sequence changed to give a 15-minute reduction. Better cooperation between Steel Producing, Rolling Mill, and Transportation supervision is needed for further improvement.
F. Change 34°-28° maintenance schedule.	$567,600 annual savings by reducing energy requirements for reheating cold steel.	Cooperation of the Operating and the Maintenance Departments to change their schedules is required.
G. Install mold preparation line and utilize 5 drags of ingot buggies (to reduce mold temperature).	Improved ingot quality. $938,000 annual savings from increased mold life (10 kg/ingot ton improvement).	This is a budget item for 1983. Work to be done: a. Install mold preparation tables. b. Design and install mold sprays. c. Obtain additional ingot buggies and molds.

TABLE 1

RECOMMENDATIONS	ANTICIPATED BENEFITS	STATUS AND ACTION REQUIRED
2. SHORT-TERM (continued)		
H. Increase blast furnace hot blast temperature to 800°-850°C.	A 1.1% increase in production and 7 kg/ton hot metal reduction in coke rate. Hot metal quality control will improve.	The present plan to increase the hot blast temperature to 1100°C should be revised to attain 800-850°C. In the foreseeable future, 1100°C will not be required. A comprehensive study by a qualified consultant is recommended.
I. Complete ore crushing and screening facilities.	A 7.5% increase in production rate and a 22 kg/ton metal reduction in coke rate.	All major items of material are on hand and completion of this project is scheduled for late 1983.
J. Train fuel engineers for all operating departments.	Energy savings through better utilization of fuels.	UEC 6-week energy course (or equivalent) to be given to selected personnel who will act as departmental fuel engineers.
K. Utilize existing natural-draft cooling tower.	Reduction of plugging and burning of cooling jackets and heat exchangers caused by solids in the river water. Blast furnace refractory life will be extended.	Karabuk management must be convinced that better quality cooling water is beneficial and take the following action: a. Inspect and repair valves, pumps, etc. b. Obtain start-up instructions from a cooling water consultant. c. Obtain advice from a water treatment company to establish a treatment program for the clarifier.
L. Recover mill scale for sinter plant use.	One-time benefit of $1.1 million from stockpile. Recurring annual benefit of $250,000.	Contract for screening of scale has been let. Work scheduled to start in October 1982.
M. Screen waste pile of limestone at the mine to recover 5 x 15 mm material for use in the sinter plant.	It is estimated that 50,000 t... can be recovered with a net value of $425,000. Will improve supply of limestone to the sinter plant and will require less crushing.	A screening contract similar to that arranged for mill scale should be negotiated.
N. Improve production and cost reporting.	Improved management control through prompt problem identification, followed by timely corrective action as required. Major benefit is stronger operating management control, maximizing steel production and quality.	Reporting practices have been improved but must be supported by controlled closing schedules. A summary monthly financial report has been developed and is available in 20 days, compared to 45 to 60 days previous to the UEC mission.
O. Revised accounting program.	Accurate and timely statistics reflecting operations/problems requiring management action.	May require on site consultants to overcome inertia at plant level and to get the program started.
P. Institute a weekly General Superintendent's staff meeting.	Improve cooperation between departments. Upgraded communications to managers will aid in the attainment of plant goals.	Implementation of this recommendation requires only the decision by the plant superintendent to hold a weekly meeting.

TABLE 1

RECOMMENDATIONS	ANTICIPATED BENEFITS	STATUS AND ACTION REQUIRED
2. SHORT-TERM (continued) Q. Obtain expert assistance for new IBM computer.	Optimum results from new computer will give timely accounting reports with fewer man-hours, providing management with better tools for operations control.	A new computer is to be received in 1983. To obtain the maximum benefits, the services of a qualified consulting firm experienced in computer applications in integrated steel plants will be required.
R. Revise operating and staff organizations.	Optimization of management effectiveness at every level.	Needs decision by top management to proceed. May require services of consultants to write responsibility descriptions.
3. INTERMEDIATE-TERM PROGRAMS A. Maximize use of coal on boilers.	This is necessary to release coke oven gas for use in rolling mills and sinter plant.	Coal firing causes superheater tube failures and engineering assistance in modifying the superheater is needed.
B. Establish utilities distribution center.	Eliminate bleeding of blast furnace and coke oven gases. Reduce cost of electrical power by 15%. Eliminate most of the 1,700 hours of heat delays in the rolling mills each year. Estimated annual savings: $4,800,000.	Karabuk management will require the following technical assistance: a. An energy survey by a qualified consulting firm. b. Design assistance for instrumentation and control. c. Assistance in writing procedures and training dispatchers.
C. Replace oil with coke oven gas at soaking pits.	A net savings of $1,834,000, resulting from: a. Increased rolling mill production of 135,500 tons per year. b. Reduced pit bottom cleaning: $62,300 per year. c. Reduced refractory usage.	To make gas available, projects relating to coke oven door repair, use of coal on boilers, and utilities distribution, must be implemented. The installation of oil/tar burners on the open hearth furnaces would also made additional gas available.
D. Improve continuous mill and abandon 12" mill.	Eliminate total annual cost of approximately $1.5 million on 12" mill.	The 12" mill is a low-volume and inefficient operation. It should be abandoned and its product rolled on the continuous mill. To obtain adequate heating time in the continuous mill furnace, it will be necessary to convert it to oil-firing.

TABLE 1

RECOMMENDATIONS	ANTICIPATED BENEFITS	STATUS AND ACTION REQUIRED
3. INTERMEDIATE-TERM PROGRAMS (continued)		
E. Supply mixed gas to sinter plant ignition furnaces.	Improved sinter strength. Reduced coke consumption. Reduced FeO in sinter.	Gas must be made available through implementation of recommendations for repairing coke oven doors, using coal in the boiler house, and establishing a utilities distribution center. Technical assistance may be needed in the design of the mixing station for coke oven and blast furnace gas.
F. Install hot metal desulfurization facilities.	$600,000 annual operating cost savings through a 45-minute reduction in heat time. Significant quality improvement, making product suitable for export. Will permit lower slag basicity and volume, and reduced coke rate at the blast furnace.	Hot metal sulfur cannot be reduced to an acceptable level at the blast furnaces, and the following action is required to install external desulfurization. a. Obtain the services of an engineering consultant to assist the Karabuk staff in performing basic engineering and preparation of a detailed specification for required equipment. b. Contract for supply of equipment and installation supervision. c. Develop a source of carbide. d. Provide a training program for engineers and operators.
G. Install open hearth roof oxygen lances and 100 T/day oxygen plant.	Reduction in heat time from 10 hours to 7 hours tap-to-tap. Reduce operating costs other than fuel by $1 per ton, or $500,000 per year Reduce fuel costs by $3,747,500 per year. This is partially off-set by the cost of oxygen. This facility is necessary to convert additional hot metal projected in Improvement Plan.	Technical assistance needed to: a. Furnish design, including oxygen plant and distribution and cooling water systems. b. Supply qualified construction supervision. c. Train personnel and give assistance in converting the process to oxygen. d. Establish practices for most effective energy usage.

TABLE 1

RECOMMENDATIONS	ANTICIPATED BENEFITS	STATUS AND ACTION REQUIRED
3. INTERMEDIATE-TERM PROGRAMS (continued)		
H. Improve quality and quantity of limestone and dolomite.	Reduce heat time by 15 minutes each for improved limestone and dolomite, for a $400,000 annual savings. Reduce number of blast furnace delays caused by inadequate supply of limestone. Possible additional revenue from sale of limestone to Ereğli.	Karabuk should have expert assistance to: a. Obtain tests and evaluate the new Balikisic dolomite mine to establish a mining plan. b. Solve the mining and delivery problems from the limestone plant. Additional mining equipment is needed. The plan offered by UEC for keeping limestone segregated by size has been put into effect at the mine with good results. Constant managerial attention is required to keep it in effect.
I. Reduce open hearth rebuild time.	Increase annual ingot production by 37,800 tons.	Karabuk management should take the following action: a. The Karabuk masonry superintendent should visit a modern open hearth shop such as U.S. Steel's Geneva Works. b. A masonry expert from a modern, operating open hearth plant should spend approximately 3 months in Karabuk conducting a rebuilding program.
J. Mechanical cleaning of soaking pit bottoms.	Labor savings of $538,000 per year.	An outside purchase of mechanical cleaning equipment is required. Bids have been submitted to Karabuk management.
K. Institute new quality control program.	Produce better product for domestic use and make the export of finished products feasible.	The quality control program recommended under UNIDO Contract No. 76/26, Project DP/TUR/72/5, should be implemented, with modifications as detailed in Section 10 of this UEC report. The assistance of a metallurgical expert experienced in process control (field control) should be obtained for 6 months.

TABLE 1

SUMMARY OF RECOMMENDATIONS FOR ADDITIONAL TRAINING AND ASSISTANCE

AREA	DESCRIPTION OF TRAINING OR ASSISTANCE	NUMBER OF ADVISORS AND ESTIMATED DURATION OF PROJECT
1. Coke Ovens	Inspect coke ovens and develop a minimal cost repair program	2 consultants to visit Karabuk for one month
2. All Operating Departments	Fuel engineer training	6 week energy course to be given at Karabuk
3. Forced draft cooling tower	Technical assistance from cooling tower consultant	1 consultant for 1 month (possibly in separate visits)
4. New IBM computer	Technical assistance	1 consultant for four months to determine most efficient utilization of new equipment. (Further programming assistance may be required with purchase of new programs).
5. Boiler House	Design assistance to modify superheater section of boilers to convert to coal firing.	1 consultant - 2 months
6. Steelmaking	a. Design of desulfurization and oxygen systems. b. Masonry Department training in open hearth furnace rebuild procedures.	Six man months of consulting engineering to assist plant engineers in performing basic engineering and preparing specification. Karabuk masonry superintendent - 1 month training in modern open hearth shop. 1 consultant - 3 months at Karabuk.
7. Blast Furnaces	Develop a plan for increasing hot blast temperature to 800-850°C in lieu of 1100°C program now contemplated.	4 consultants - 3 months

TABLE 2

AREA	DESCRIPTION OF TRAINING OR ASSISTANCE	NUMBER OF ADVISORS AND ESTIMATED DURATION OF PROJECT
8. Limestone and Dolomite Mines	Technical assistance to inspect and develop a mining plan at Balikisic dolomite mine and to upgrade operations at the limestone mine.	1 consultant - 2 months
9. Raw materials - blending yard	Expert assistance in setting stacking and reclaiming parameters, establishing testing and quality control procedures and assisting in start-up of blending yard equipment.	2 consultants - 2 months
10. General Plant		
a. Quality Control	Metallurgical expert to assist in installing the quality control program.	1 consultant - 6 months
b. English Language	Technical English training for management and engineers.	1 English language instructor
c. Modern Management Methods	A program to train employees of Karabuk to act as conference leaders. These people will then give a 96 hour course in Turkish to all management employees.	One month is needed to train conference leaders.
d. Computer	Basic computer functions for management.	Requires an instructor for 2 months to teach all involved employees.

TABLE 2

AREA	DESCRIPTION OF TRAINING OR ASSISTANCE	NUMBER OF ADVISORS AND ESTIMATED DURATION OF PROJECT
10. General Plant (Continued) e. Safety	Fundamentals of an effective safety program.	A concentrated course, two weeks in length, requiring an instructor for approximately 4 months. Should be followed by a consultant to analyze Karabuk operations and recommend an expanded safety department and its accompanying responsibilities.
f. Accounting, Personnel Services, Industrial Engineers and Engineers	a. Statistical Analysis b. Use of computer terminals c. Computers for Engineers	University extension courses to be conducted at plant site.

TABLE 2

SUMMARY OF RECOMMENDATIONS WHICH HAVE BEEN ADOPTED BY KARABUK WORKS

RECOMMENDATIONS	BENEFITS
1. SINTER PLANT	
A. Revise maintenance schedule.	Machine availability increased 3.5%.
B. Improve raw material size.	Improved coke size reduced FeO in sinter by 3%. Use of 2 ore crushers has increased sinter strength.
C. Install weigh belt feeders on sinter mix bins.	Improved sinter chemistry control.
D. Install new ignition furnace.	Improved sinter strength.
E. Use roll scale in sinter mix.	One-time benefits of $1.14 million and continuing annual savings of $0.245 million.
2. BLAST FURNACES	
A. Operate coke crusher.	3.5% increase in hot metal production. 1.5% reduction in coke rate.
B. Reduce coke ash.	Reduced slag volume.
C. Remove gangue material from limestone.	Reduced slag volume.
D. Improve limestone particle size.	Increased production of hot metal.
E. Change filling sequence on No. 3 blast furnace.	Increased useful life of the bells.
3. STEEL PRODUCING	
A. Reinforce scrap preparation building.	Increased steel production by permitting 2-crane operation.
B. Mold spray design is in progress.	Improve mold life.
C. Change pouring sequence.	Reduced transit time.
D. Run trial heats with addition of burnt lime.	Lower sulfur content in hot metal.
E. Reduce air infiltration to furnaces.	Reduced heat time, lower fuel consumption.
F. Reduce fuel consumption by observing heat profile.	Lower fuel costs.
G. Assign engineer to study methods for improving door life.	Decreased air leakage and maintenance costs.
H. Work is in progress on modifying furnace roof and reducing rebuild time.	Reduced maintenance costs, greater furnace availability.

TABLE 3

RECOMMENDATIONS	BENEFITS
4. ROLLING MILLS	
A. Assign an engineer to be solely responsible for soaking pits.	Increased production through better pit operation.
B. Eliminate hold time on all semi-killed heats.	Lower transit time, improved quality, reduced fuel consumption, and increased soaking pit production.
C. Develop and install new transit time report.	Will identify cause of transit delays and allow corrective action to be taken.
5. POWER AND FUEL	
A. A trial was made using additional mixed gas on one soaking pit.	Increased refractory life and soaking pit utilization through elimination of fuel oil.
B. Soaking pit damper repair is in progress.	Increased production from better control of pit pressure and higher preheated air temperature.
6. ACCOUNTING AND COST	
A. Prepared special report to the President displaying prior months' production, sales, and selected costs by the 20th of each month.	Provides top management with information needed to take quick action to change undesirable trends.

(b) In so far as the training system is concerned, much interaction was fostered between the work of the training expert and the subcontractor team. It was therefore ensured that the training system proposed fully took into account the recommendations for changed practices and/or new projects either already installed during the project or recommended for later installation. The accent again was on improving the existing work force; although the scheme proposed also envisages, at a later stage, training of new entrants. The more urgent of the recommended training programmes were installed by the expert during his mission and met with much enthusiasm from all levels of the establishment both at Karabük and İskenderun. It is therefore reasonable to expect that the activity will be continued by the counterpart management.

The expert's recommendations are summarized as follows:

- Training of Departmental Trainers/Training Coordinators/Training Personnel : Technical and practical training of operation personnel, and to a great extent skilled and semi-skilled maintenance workers, is essentially to be given on-the-job, and in the plant. It is therefore necessary to train and develop a strong cadre of Departmental Trainers and Coordinators at the plant level, so that on-the-job training of operators and maintenance workers can be systematized, consolidated and accelerated.
- Individual Training Projects : 47 Engineers/Chief Engineers of the Karabük Plant, and 36 of the Iskenderun Works were given an intensive course on "Training of Trainers" by the expert. Each participant as a part of the course, selected a Departmental Training need as a project assignment, to be analysed, course developed and introduced for their departmental men. These projects need to be followed-up, finalised and introduced by them.

- Strengthening of the Organisation for Training : The Training Departments of the two plants need reorganization .d the injection of a few good technical personnel, so that the Company's training activities at the two locations can be strengthened and conducted on a systematic and continuing basis.
- Technical Training Centre : The İskenderun Works is fortunate in having a well equipped Technical Training Centre. There are however a few constraints and difficulties, which are preventing full use being made of these facilities. These must be overcome.
- Training of Counterpart Personnel : In order to continue plant and company training activities for optimisation, modernisation and short term and long term expansion, counterpart training personnel need to be trained through further programmes, more association with the training expert, and a few fellowships. Transfer of technology in this mission was limited due to the short duration of the assignment, and the lack of suitable persons in the Training Department to work with and learn from the UNIDO expert.
- Supervisory Development Course : Only one batch of 26 first line supervisors of the Karabük Plant were given a 5-day Supervisory Development Course, with emphasis on supervisory skills. In order to develop a strong first line supervisory team, all such supervisors of all units -technical and non-technical- must be put through such a "Supervisory Development Course" in batches of 20 so that the work of the departments in not disrupted.
- Middle-Management Development Course : In order to strengthen the Company's management team, and integrated with the other levels of management, management development courses need to be developed, designed, organised and conducted for middle-management personnel such as engineers, general foremen and professionals. These courses should cover technical and management areas. This programme can be taken up simultaneously with courses mentioned earlier.

- Executive Development Programme : The top-level of management personnel - chief engineers and above- have requested and need, both broad-based courses on managerial skills, problem-solving, decision making, etc. as well as specific courses of a technical and professional nature. These can be introduced on a seminar basis initially, and later a full-time 10 to 15-day Management Development Course should be introduced for all Company executives.

- English Language Training : For the professional development of engineers, middle-management and executives, the English Language Teaching Programme should be reviewed, modified and re-introduced.

- Manpower Planning : Manpower is a key economic resource for any of the economic sectors of a country. Its value increases with the higher importance paid to industrialization in the various sectors of the economy. It is an accepted fact that establishment of a steel industry is basic to the industrial development of a country. But this requires high capital, sophisticated technology and highly skilled and qualified manpower to make the industry operative and competitive in the national and international field. There is a need for systematic manpower planning which will assess the availability of manpower within the Company and without, the losses likely to occur due to separations over the next few years, the new demand due to modernisation, diversification and expansion, and a manpower plan that will ensure availability of trained manpower both quantitatively and qualitatively, at the time needed.

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