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REPORT

PRE-INVESTMENT SURVEY OF FERTILIZER INDUSTRY OF TURKEY

OCTOBER 9, 1962

Ford, Bacon & Davis
Incorporated
Engineers

CHICAGO NEW YORK SAN FRANCISCO

Contents

Subject	Page
Letter of Transmittal	1
Major Conclusions and Recommendations	4
Nitrogenous Fertilizers	4
Phosphatic Fertilizers	8
Recommended Program	8
Potassium Fertilizers	9
Insecticides and Fungicides	10
Root Nodule Bacteria	10
Existing Fertilizer Industry	11
Consumption - Imports	13
Consumption - Domestic Products	13
Estimated Future Requirements	13
Nitrogenous Fertilizers	14
Hydrogen from Coal or Lignite -	
Karabuk Steel Mill By-products	15
Azot Plant	15
Process Description - Azot Plant	17
Comments	19
Hydrogen from Petroleum Products	20
Hydrogen from Gases	24
Alternate Nitrogen Source	24
Phosphatic Fertilizers	25
Karabuk Superphosphate Facility	25
Yarimca Superphosphate Plant	26
Iskenderun Superphosphate Plant	27
Exploration	28
Ammonium Phosphate	29
Potassium Fertilizers	29
Camalti Salt Plant	30
The Salt Lake Facility	31
German and American Experience	31
Other Sources	32
Insecticides and Fungicides	33
Agro-Merck	33
Koruma	34
Rabak	35
Root Nodule Bacteria	36
Management Problems -	
Personnel	37
Government Regulations	38
Production Tax Law	39

Contents

Subject	Page
Management Problems - (concluded)	
Government Regulations (concluded)	
Income Tax Law	39
Corporation Tax Law	40
Fiscal Procedure Law	41
Labor Law	42
Other Taxes Affecting Industry	43
Communication	43
Power	44
Foreign Investment -	
Foreign Investment Encouragement Law	45
Foreign Investment Guaranty Programs	47
	Exh.No.
Exhibits:	
Map - Railroads, Principal Highways, and Industrial Cities	1
Map - Transmission Network	2

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CHICAGO CONSTRUCTION VALUATIONS REPORTS MANAGEMENT SAN FRANCISCO

2 BROADWAY
NEW YORK 4

New York, October 9, 1962

Agency for International Development
Washington 25, D.C.

Dear Sirs:

We transmit herewith the results of our survey of Turkey's fertilizer industry. The purpose of this report was to provide a general guide for prospective investors, Turkish and non-Turkish, and for planning the development of the industry.

We found only one good immediate prospect for investment: a plant to make nitrogenous fertilizers from refinery products now available at Turkish refineries. A plant to produce about 130,000 tons of product would cost about TL 135 million to construct, and we believe it could be operated competitively. We recommend immediate detailed investigation of the technical and economic feasibility of such a plant.

The present domestic industry is principally comprised of two superphosphate plants, each having an annual capacity of 120,000 tons, and one nitrogenous fertilizer plant, capacity 110,000 tons. The latter is Government-owned-and-operated, the former are Government-financed to a considerable degree and operate under Government price controls. The Government-owned-and-operated Karabuk steel mill has additional capacity for 5,000 tons per year of ammonium sulfate and 22,000 tons of superphosphate. Thus, because there is at present no

private fertilizer industry, a prospective private investor should investigate thoroughly the probable effects of Government regulations and should get assurances of long-range Government co-operation. Government on its part should be most favorably inclined toward a privately financed, economically feasible project, using locally available raw materials, which would manufacture vital fertilizer products.

Turkey's present 377,000 tons' annual fertilizer production capacity falls far short of the country's urgent needs. By 1970, total requirements are estimated to be about 2 million tons. Assuming that present equipment will be operated at full capacity, new manufacturing facilities plus imports must produce upwards of 1.6 million tons if requirements are to be satisfied.

In spite of the magnitude of anticipated requirements, the fertilizer industry, except for the plant cited above, shows little promise for profitable investment in the near future. Two main factors contribute to this conclusion:

(1) Indigenous raw materials are not presently available.

(2) The lack of money, credit, and, in many cases, incentives on the part of farmers to buy fertilizer.

Long-range prospects depend upon continued exploration and development of phosphate rock deposits and upon efforts on the part of Government to educate and provide financial assistance to farmers in the use of fertilizer.

While the importance of increased agricultural yields is recognized as a major component of the general economic and social welfare of the country, this report of necessity confines itself to the technical and economic aspects of fertilizer production and distribution.

We include also a brief review of insecticide and fungicide production in Turkey and mention the promising root nodule bacteria program of Turkey's Soil and Fertilizer Research Institute because, along with fertilizer, they are important to Turkey's agricultural yields.

Concurrently with this survey, we made studies of Turkey's chemical industry and metalworking industry. Where they deal with common subjects the language in all three reports may be similar or identical.

The body of our report follows.

Very truly yours,

(signed) FORD, BACON & DAVIS, Inc.

MAJOR CONCLUSIONS AND RECOMMENDATIONS

This report, prepared by Ford, Bacon & Davis, Inc. ("Engineers") for the Agency for International Development ("AID"), presents the results of inspection of all Turkey's existing fertilizer plants and interviews with plant managers, Government officials, and technical advisers. Exhibit No. 1 is a map of Turkey showing the location of principal cities and places referred to in this report.

The estimates of Turkey's future fertilizer requirements used in this report were furnished to the Engineers by the Soil and Fertilizer Research Institute of the Ministry of Agriculture.

The Engineers are indebted to many Turks who gave generously of their time and knowledge in connection with this work. They acknowledge particularly the help given by the Ministry of Agriculture, the Soil and Fertilizer Research Institute, the Mining Assistance Commission, Azot Sanayii T.A.S. (Nitrogen Industry, Inc.), and Gubre Fabrikalari, T.A.O. (Fertilizer Factories, Inc.). Special thanks go to Mr. Safai Inal and Mr. Mesut Ozuygur who worked with the Engineers during the entire survey.

Dollar equivalents of Turkish Lira (TL) are calculated at the official exchange rate (TL 9 = $1); 100 kurus = TL 1; tons wherever used are metric tons; one hectare = 2.47 acres.

Nitrogenous Fertilizers

Turkey's present production capacity for nitrogenous fertilizers is 115,000 tons per year of which 110,000 tons are produced in the new State-owned Azot plant at Kutahya which recently began operations. Through 1961 the only production was about 5,000 tons per year produced at Karabuk as a by-product of

the State-owned steel mill. Imports over the past 10 years have ranged from 17,000 tons to 130,000 tons annually. Consumption in 1961 was about 135,000 tons.

Requirements for nitrogenous fertilizers are based on soil conditions, hectarage, and the Ministry of Agriculture's programs for increasing fertilizer use. Estimates are 250,000 tons in 1963 increasing to 650,000 tons by 1970. To achieve these goals the Engineers recommend the following program, assuming feasibility studies prove favorable and proper financing for new plants can be obtained. As a part of the program, marketing and distribution organizations should be developed and continuing efforts made to sell fertilizer. Marketing studies should determine the number, size, and location of necessary mixing and bagging facilities in various agricultural districts.

Recommended Program

1963

1. Operate the Azot plant at Kutahya and the facility at Karabuk at full production capacity.
2. Prepare detailed technical and economic feasibility reports on a plant adjacent to the refinery at Izmit to make ammonium nitrate and/or urea from refinery products. This report should serve as a financial analysis acceptable to prospective investors.
3. Import balance of fertilizer requirements over and above actual production.

1964

1. Start construction of ammonium nitrate and/or urea plant at Izmit if detailed study shows it to be feasible.

2. Prepare detailed technical and economic feasibility report on expansion of Kutahya plant. This report should be prepared to satisfy prospective investors even though the Government may provide the capital for construction.

3. Import the balance of fertilizer requirements.

1965

1. Complete construction of ammonium nitrate and/or urea plant and start production.

2. Begin construction of expansion at Kutahya if detailed study shows it to be feasible.

3. Construct facility at Eregli for recovery of ammonium sulfate.

4. Prepare feasibility study of second ammonium nitrate and/or urea plant at Mersin.

5. Import the balance of fertilizer requirements.

1966

1. Utilize full production capacity at ammonium nitrate and/or urea plant at Izmit.

2. Complete expansion at Kutahya and start production.

3. Utilize full production capacity of ammonium sulfate at Eregli.

4. Begin construction of second ammonium nitrate and/or urea plant at Mersin if study shows it to be feasible.

5. Import the balance of fertilizer requirements.

1967

1. Utilize full production capacity of expanded plant at Kutahya.

2. Complete construction of second ammonium nitrate and/or urea plant and start production.

3. Import the balance of fertilizer requirements.

1968-1969

1. Prepare a detailed feasibility study to double the size of the Mersin ammonium nitrate and/or urea plant and start construction of this expansion if feasible.

2. Import the balance of requirements.

1970

Utilize full production capacity making Turkey largely self-sufficient in nitrogenous fertilizers.

This program is shown in tabular form below:

Tentative Schedule - Nitrogenous Fertilizer Program
(thousand tons)

	1963	1964	1965	1966	1967	1968	1969	1970
Present Capacity								
Kutahya	110	110	110	110	110	110	110	110
Karabuk	5	5	5	5	5	5	5	5
Potential New Capacity (A)								
Izmit Refinery	-	-	65 (B)	130	130	130	130	130
Eregli Steel Mill	-	-	-	5	5	5	5	5
Kutahya (Expansion)	-	-	-	55 (B)	110	110	110	110
Mersin Refinery	-	-	-	-	65 (B)	130	130	260 (C)
Total Production	115	115	180	305	425	490	490	620
Imports	135	185	170	95	25	10	60	30
Total Requirements	250	300	350	400	450	500	550	650

Note: (A) Depends on detailed feasibility findings. Schedule should be revised each year to reflect actual results and new forecasts.

(B) 6 months' operation.

(C) Expansion of Mersin to double size.

Phosphatic Fertilizers

Turkey's present production capacity for phosphatic fertilizers is 262,000 tons per year. The superphosphate plants at Yarimca and Iskenderun, each with 120,000-ton capacity, import the phosphate rock and sulfuric acid. The 22,000-ton facility at Karabuk steel mill imports phosphatic rock but uses sulfuric acid which it produces.

Imports of phosphatic fertilizers over the past 10 years have been negligible except for 50,000 tons which were imported in 1961.

Turkey's requirements for phosphatic fertilizers will be 300,000 tons in 1963 and will increase to 1.25 million tons in 1970 as the Ministry of Agriculture's programs for distribution and use are developed.

Indigenous phosphate rock and sulfuric acid have not been produced in sufficient quantities to meet requirements, making imports necessary.

A sulfuric acid plant has been built at Murgul, the total production of which will be consumed at the Yarimca and Iskenderun plants.

Recommended Program

Because of the uncertainty of the schedule for developing domestic sources of phosphate rock, it is impossible to prepare a time schedule for making Turkey self-sufficient in phosphatic fertilizers. Following is a listing of the Engineers' major recommendations:

1. Operate present facilities at Yarimca, Iskenderun, and Karabuk at full capacity.

2. Add recycling equipment at Iskenderun and granulating facilities at Yarimca to produce granular fertilizer rather than run-of-pile.

3. Import phosphate rock and sulfuric acid as required for present facilities until native sources for these raw materials can be developed.

4. Allocate sufficient funds to vigorously search for and develop phosphate deposits in Turkey.

5. Allocate funds to increase domestic production of sulfuric acid.

6. When domestic phosphate rock becomes available in quantity, prepare detailed feasibility studies of new plants for production of triple superphosphate or concentrated superphosphate fertilizer.

7. Co-ordinate marketing and distribution efforts for phosphate fertilizers with those for nitrogenous fertilizers. As part of these surveys, study the feasibility of constructing mixing and bagging facilities in the various agricultural districts in accordance with their needs.

8. Import the balance of phosphatic fertilizer requirements over and above domestic production.

Potassium Fertilizers

There is no present production of potassium fertilizer in Turkey. Estimated requirements are small compared to nitrogenous and phosphatic products. The Soil and Fertilizer Research Institute estimates a need of 10,000 tons in 1963 increasing to 40,000 tons by 1970.

To provide these requirements from domestic raw materials, the Engineers recommend a Government geological search for potassium salts deposits. Assistance should be solicited from petroleum companies which may have encountered potassium containing salt deposits during drilling operations.

The Engineers also recommend that chemical tests be made of cement kiln flue dust, blast furnace discharge, and sugar mill residues to determine whether the quantities of potassium salts present warrant a detailed study of the technical and economic feasibility of facilities to collect the potassium for fertilizer purposes.

A plan to separate potassium chloride from the bitterns now being returned to the sea at the Camalti saltworks is not recommended until the above possibilities have been thoroughly explored and found inexpedient.

Insecticides and Fungicides

The four companies now compounding insecticides in Turkey have sufficient capacity, production know-how, and marketing ability to supply Turkey's present and short-range future demand. They are doing a good job and will expand as the market expands. Therefore, the Engineers see no present new investment possibilities in the field of insecticides.

Presently, all active ingredients are imported. Domestic fillers, which comprise over 95% of the finished products, are used. One company, Koruma, is planning to produce its own active ingredients in a plant scheduled for completion in 1963. Virtually all raw materials used by this plant will be domestic.

The demand for fungicide is about 1,200 tons per year and is presently being met by imports. The Rabak plant in Istanbul has facilities for producing 1,500 tons per year of copper sulfate, a product now being imported in quantity. This facility was closed because of high production costs. In view of the possible savings in foreign exchange, the Engineers recommend that every effort be made to operate this facility, if it is at all feasible. This plant could supply all of Turkey's present demand for this type of fungicide.

Root Nodule Bacteria

Root nodule research is a function of Government. Turkey's Ministry of Agriculture is making good progress in this field. There is no area here for private investment, but the Engineers recommend continued expenditures by the Government to keep on with this research and expand it to the point where it will result in greater agricultural yields.

EXISTING FERTILIZER INDUSTRY

The principal fertilizer chemicals are products of three elements required to sustain plant life; namely, nitrogen, phosphorus, and potassium. They are not applied to the soil in their elemental form but are converted to readily assimilated compounds such as ammonia and its ammoniacal and nitrate salts, urea, phosphate, etc. Most commercial fertilizers are single-element plant foods or combinations of two or three elements in varying proportions, depending on the needs of the various soils. When Turkey's production of the three types of fertilizer reaches significant proportions, mixing and bagging facilities along with distribution warehousing should be located at strategic points in the agricultural areas. Such operations should be originated and administered by marketing organizations.

The following table shows production and imports of fertilizers in Turkey from 1950 through 1961. Consumption is assumed to be the sum of production and imports.

Production and Imports of Fertilizers in Turkey
(tons)

Year	Total			Nitrogenous Materials			Phosphatic Materials			Potassium Materials		
	Production	Imports	Total (Consumption)	Production	Imports	Total	Production	Imports	Total	Production	Imports	Total
1950	15,895	26,208	42,103	2,762	26,138	28,900	13,133	-	13,133	-	70	70
1951	21,589	20,981	42,570	2,675	17,170	19,845	18,914	3,599	22,513	-	212	212
1952	24,555	42,765	67,320	3,321	23,603	26,924	21,234	12,445	33,679	-	6,717	6,717
1953	26,517	56,023	82,540	4,490	41,812	46,302	22,027	9,085	31,112	-	5,126	5,126
1954	44,309	37,753	82,062	4,232	16,837	21,069	40,077	355	40,432	-	20,561	20,561
1955	88,637	49,489	138,126	4,276	48,195	52,471	84,361	-	84,361	-	1,294	1,294
1956	30,034	51,998	82,032	4,151	39,706	43,857	25,883	-	25,883	-	12,292	12,292
1957	38,078	42,836	80,914	4,396	42,836	47,232	33,682	-	33,682	-	-	-
1958	28,512	41,842	70,354	4,383	41,842	46,225	24,129	-	24,129	-	-	-
1959	60,995	114,996	175,991	2,995	114,996	117,991	58,000	-	58,000	-	-	-
1960	67,622	42,820	110,442	4,622	41,463	46,085	63,000(E)	1,357	64,357(E)	-	-	-
1961	(NA)	178,941	(NA)	4,267	129,533	133,800	(NA)	49,377	(NA)	-	31	31

(E) Estimated
(NA) Not Available

Source: 1950-59 - Turkish Soil and Fertilizer Research Institute.
1960-61 - Import statistics and Karabuk production data.

Consumption - Imports

Prior to World War II, Turkey imported virtually no fertilizers. Since 1945, when 682 tons of nitrogenous materials were imported, there has been a general trend upward in imports of nitrogenous, phosphatic, and potassium materials. Reduced amounts of fertilizers were imported during some of the years between 1950 and 1960, without offsetting increases in domestic production.

Nitrogenous materials represent the principal imported fertilizer. During the 5-year period, 1955-59, there were 287,575 tons of nitrogenous fertilizers imported and 13,586 tons of potassium sulfate. During 1961, about 130,000 tons of nitrogenous and 49,377 tons of phosphatic materials were imported.

Consumption - Domestic Products

Domestic production of fertilizers began in 1939, with 182 tons of nitrogenous materials. Production did not increase greatly until after World War II, and in 1959 a total of 2,995 tons was produced, after reaching a peak of 4,490 tons in 1953.

On the other hand, phosphatic materials were first produced in Turkey in 1944 with 2,486 tons. The production of these materials increased more rapidly than the production of nitrogenous materials reaching 58,000 tons in 1959, after a peak of 84,361 tons in 1955. Some imports were necessary in the early 1950's, but as domestic production almost doubled in 1954 and 1955, there were scarcely any imports. Apparently, demand exceeded local production in 1961, as large-scale imports resumed, with 49,377 tons being imported.

Estimated Future Requirements

The Soil and Fertilizer Research Institute of the Turkish Ministry of Agriculture has made an extensive study of soil conditions in all areas of Turkey and provides the basis for

the conclusions shown herein.

The following table of fertilizer requirements, prepared by the Institute, is very ambitious compared with past usage, falls far short of the actual needs of the soil, and is far above the present capabilities for domestic production.

Forecast of Turkey's Fertilizer Requirements
(tons)

Year	Nitrogenous	Phosphatic	Potassium	Total
1963	250,000	300,000	10,000	560,000
1964	300,000	400,000	10,000	710,000
1965	350,000	500,000	15,000	865,000
1966	400,000	650,000	20,000	1,070,000
1967	450,000	800,000	25,000	1,275,000
1968	500,000	950,000	30,000	1,480,000
1969	550,000	1,100,000	35,000	1,685,000
1970	650,000	1,250,000	40,000	1,940,000

Nitrogenous Fertilizers

Four fifths of the air blanket covering the earth is nitrogen, providing an inexhaustible supply of the element. However, unless it can be "fixed" (made to combine) with other elements, such as hydrogen, carbon, or oxygen, it cannot be made available to plant life.

Hydrogen is the most used and generally the most economic fixation medium for nitrogen. Sources of hydrogen include natural gas, water, petroleum products, coal, and lignite.

At this date Turkey has very little, if any natural gas; nor is there an abundant supply of cheap electricity to electrolyze water economically to separate the hydrogen. Turkey's present petroleum refinery capacity of approximately 4,780,000 tons of crude oil per year is large enough to provide a quantity of petroleum products for ammonia synthesis.

Hydrogen from Coal or Lignite

Karabuk Steel Mill By-products

The gases from the coke works at Karabuk contain small amounts of ammonia. When sulfuric acid is used to wash the gas stream, the ammonia combines with the sulfuric acid to produce ammonium sulfate. The integrated coke and steel plant thus produces a chemical fertilizer as a by-product. About 5,000 tons per year are recovered for sale to the agricultural industry.

At Eregli, a new steel mill is being constructed. Approximately the same amount of ammonium sulfate could be produced there but there are no present plans for its recovery.

Azot Plant

The Azot plant at Kutahya is Turkey's main producer of nitrogenous products. It was constructed by Badische Anilin and Sodafabrik and began operations late in 1961. From lignite, air, and gypsum, the following products are manufactured:

	Capacity in Tons per Year
Ammonium Sulfate	60,000
Ammonium Nitrate-Limestone	50,000
Ammonium Nitrate (Tech. Grade)	3,000
Nitric Acid (98%)	6,000
Ammonium Nitrate-Sulfate	5,000

Estimated production costs of the products are:

	Kurus/Kg	Cents/Lb
Ammonium Sulfate	93.90	4.7
Ammonium Nitrate-Limestone	94.70	4.8
Ammonium Nitrate (Tech.)	160.60	8.1
Nitric Acid (98%)	165.80	8.4
Ammonium Nitrate-Sulfate	155.43	7.9

These costs are more than double the price of similar imported materials.

Early Azot production costs for a few of the chemicals are compared below with current quotations of the "Oil, Paint, and Drug Reporter" (large quantities fob. New York).

	Cents/Lb	
	Azot	O.P.D.R.
Ammonium Sulfate	4.7	1.6
Ammonium Nitrate-Limestone	4.8	2.2
Ammonium Nitrate (Tech. Grade)	8.1	-
Ammonium Nitrate (Fert. Grade)	-	3.2

Although early Azot costs are significantly higher than the price of imports, production costs of any new operation are normally higher during the start-up period. As these operations progress, production costs should be reduced.

Azot may need expert technical help. Consideration should be given to importing a management team to operate this facility and to train personnel to assume management responsibilities.

The Azot management has recently completed studies recommending expansion of the plant by 125%. The report indicates that at full production costs in the present plant are estimated to be TL 783 ($87) per ton and in the expanded plant TL 465 ($52) per ton. The present plant is expected to show an annual operating loss of TL 33 million ($3.7 million) when operating at full capacity and with the selling price of the fertilizer at TL 560 ($62) per ton. The expanded plant is expected to show an annual profit of about TL 23 million ($2.6 million), including sale of industrial chemicals in addition to fertilizer. If these estimates are correct, the expansion of the Azot plant appears to be feasible. The Engineers recommend a detailed technical and economic feasibility study be made after the present plant has operated normally for a year or more.

Process Description - Azot Plant

Ammonia:

Hydrogen is derived from ground-dried lignite, oxygen, and steam in a Winkler gas generator. The gas produced is scrubbed with water to remove particulate matter and carbon dioxide. The carbon dioxide is recovered. The small amount of hydrogen sulfide is removed by passing the gas through beds of limonite and sawdust. Carbon monoxide is removed by shift conversion after three stages of compression (15 atmos.) followed by a final scrubbing with liquid nitrogen.

Nitrogen as well as oxygen is produced in a Linde (German) air fraction system. The oxygen is used in the Winkler gas generator. The nitrogen is used in the synthesis loop and for scrubbing carbon oxides from the synthesis gas stream. Final scrubbing of the synthesis gas is done with a caustic solution.

A modified Haber-Bosch synthesis is used. A seven-stage compression system (0.8-, 4.0-, 15.5-, 28.0-, 65-, 125-, 255-kg/cm^2 discharge pressure) is employed having electric drives. Three double-stage and one single-stage unit are used. The circulator is steam-driven, and the converter is capable of handling 120 tons per day of ammonia production.

Nitric Acid:

Nitric acid is produced from gaseous ammonia and air at atmospheric pressure on a Pt-Rd gauze in an Oschats converter. The diameter of the gauze is about 3 meters and consists of five layers. Waste heat is absorbed from the two converters with internal coils. The nitrogen oxides are compressed and absorbed in a four-tower counter-current chain to produce 57% nitric acid. The 98% nitric acid is produced by further oxidation with oxygen in an autoclave. This acid is shipped to Elmadag for use in explosives manufacture. The calculated capacity of the nitric acid

plant is 36,000 metric tons per year on a 100% basis.

Ammonium Sulfate:

Ammonium sulfate is produced from ammonia, carbon dioxide, water, and gypsum according to the following reactions:

(1) $NH_3 + CO_2 + H_2O \longrightarrow (NH_4)_2CO_3$

(2) $(NH_4)_2CO_3 + CaSO_4 \longrightarrow (NH_4)_2SO_4 + CaCO_3\downarrow$

Ammonium carbonate is produced in two towers - first by the absorption of ammonia in water in the first column, and second by the reaction of carbon dioxide with the aqua ammonia. Ground calcium sulfate is added to an agitated reactor in stoichiometric quantities to produce ammonium sulfate and calcium carbonate. The calcium carbonate is removed from the slurry by continuous vacuum filtration. The ammonium sulfate solution is concentrated in multiple-effect evaporators, crystallized, and separated by continuous centrifugation. The wet crystals are dried in a steam-heated rotary dryer.

Ammonium Nitrate:

Ammonium nitrate is made from gaseous ammonia and 57% nitric acid by conventional neutralization and concentrated to either 83% or 92% prior to crystallization or blended with calcium carbonate or ammonium sulfate to produce ammonium nitrate-limestone or ammonium nitrate-sulfate.

Ammonium Nitrate-Limestone:

Ammonium nitrate-limestone is made in a crude, ribbon-screw-type granulator with the addition of wet lime to the hot crystal slurry of ammonium nitrate. The granulation is good, but the granules range from about 6 to 20 mesh. The product is dried in a steam-heated rotary dryer.

Ammonium Nitrate-Sulfate:

Ammonium nitrate-sulfate is produced in the same granulator as the ammonium nitrate-limestone by the addition of wet ammonium sulfate crystals to the ammonium nitrate slurry.

Comments

Construction of this plant was started 6 years ago, with many delays being experienced during the construction period. Final cost was about TL 585 million ($65 million). The plant is well built and has good equipment.

The physical layout of the equipment is such that the direct operating labor requirements are inordinately high.

Technical and mechanical difficulties have been experienced during the start-up period. The most serious was an explosion in the ammonia oxidation section of the nitric acid plant. This explosion demolished a blower, the ductwork, and the filtering system of the ammonia-air stream just prior to entering the oxidation chamber. One of the two units was rendered inoperative. As a result, the nitric acid plant was completely shut down for repairs for an extended period.

If technical assistance from outside the country is requested by operating personnel, this should be expedited not only for economic but for safety reasons.

At the Azot nitric acid plant the ammonia and air are premixed prior to transporting the gases through the blower and filter system. The nitric acid plants with which the Engineers are familiar mix the air and ammonia just prior to entering the converter, thus materially reducing the chance of explosion.

Atmospheric-pressure oxidation of ammonia to nitric acid is used in Europe because of the relatively high cost of ammonia compared to U.S. costs. The efficiencies obtained from an atmospheric oxidation unit are generally in the vicinity of

96-97% based on ammonia; whereas in the U.S. using du Pont pressure units the conversions are about 91-92%. The capital cost to construct an atmospheric oxidation unit is considerably higher than with a pressure unit. However, this may be a small factor in determining operating costs over a long period of time.

In the opinion of the Engineers, an independent survey by qualified engineers is required to inspect the Azot plant under normal operating conditions and make a detailed material balance and efficiency study of the operations. As the plant has been in operation only a short time, such study has not yet been made. The Engineers estimate this survey would take two men several months. Should this study be made, serious consideration should be given to the feasibility of installing solid ammonium nitrate facilities to eliminate the high cost of manufacturing ammonium sulfate from ammonia, carbon dioxide, and gypsum. With the dry climate in central Turkey there should be no problem in the matter of bulk storage of solid ammonium nitrate. This would facilitate inventory control, and the solid material would not have to be bagged until ready for shipment. From a capital cost standpoint, this would probably be advantageous because of the excellent warehouses and conveyor systems already installed. Possibly the only modifications necessary would be to use epoxies or some other protective coating material on the steelwork in the warehouses and to use polyethylene lining on the concrete floor and sidewalls so that the ammonium nitrate would not attack it.

Hydrogen from Petroleum Products

A detailed study should be made of the technical and economic feasibility of producing nitrogenous fertilizers, using hydrogen from petroleum products, to fix atmospheric nitrogen. Such plants, if feasible, should be built adjacent to the refiner-

ies so that the raw material can be transferred by pipeline.

In the Engineers' opinion the naphthas provide one of the best raw materials for the suggested plants. In Turkey, this product is more available than the heavier fractions such as fuel oil for which a good market is expected.

The management of Azot Sanayii T.A.S. has recently completed a report, proposing a second nitrogen plant to use heavy fuel oil to make ammonium nitrate. That report recommends a plant to make 172,000 tons per year of a 30% nitrogen product at a cost of TL 568 ($63) per ton. Capital cost would be TL 293 million ($33 million). The report further states that additional studies should be made when more information is obtained at the refineries as to the comparative availability of the various refinery products.

Turkey has three operating refineries. These are essentially distillation-skimming units and are listed below with their approximate crude oil capacities:

Turkey's Refineries

Location	Operating Company	Ownership		Crude Capacity (tons)
Mersin	Anadolu Tasfiyanesi A.S. (ATAS)	Socony-Mobil Shell British Petroleum	56% 27 17	3,200,000
Izmit	Istanbul Petroleum Refinery A.S. (IPRAS)	Government Caltex	51 49	1,000,000
Batman	Turkish Petroleum A.D. (TPAO)	Government	100	580,000

The products from these refineries include naphthas, LPG, gasoline, kerosene, diesel oil, and fuel oil.

With the exception of the naphthas, the refinery managements at Mersin and Izmit expect their products to be eventually

fully consumed in the local market. This is fortunate because, even though hydrogen can be made available through processing any of the refinery products, it is more economically accomplished from the lighter fractions such as the naphthas.

Considerable technical and economic analyses would be required to review the complete range of raw materials that could be used to fix nitrogen from refinery products. Some of the possibilities, however, may be ruled out, such as the use of the hydrogen gas normally generated at a refinery. At the Izmit and Mersin refineries, what little hydrogen is produced is used at the refinery itself, to desulfurize one or more of the products.

The Izmit refinery naphtha stream is offered here as an example of one of the possibilities that could be assigned to petrochemical processing. There are available some 100,000 tons per year of stabilized straight-run naphthas and 50,000 tons of unified light naphthas at Izmit. The specifications of these materials are as follows:

	Stabilized Straight-run Naphtha	Unified Light Naphtha
Gravity - API	64.1	80.9
Density at 15°C	0.7232	0.6661
Color - Saybolt	- 30	- 30
Distillation Range:		
Initial Boiling Point - °F	126	98
End Point - °F	315	216
Aromatics - volume %	8.4	4.5
Olefins - volume %	Nil	Nil
Naphthenes - volume %	25 (est.)	Not available
Sulfur - weight %	0.13	0.0003
Reid Vapor Pressure - pounds	4.3	16.1
Copper Corrosion	Pass	Pass
Doctor Test	Positive	Negative
Bromine Number	Nil	Nil
Thermal Value - Btu/lb:		
Gross	20,000	20,600
Net	19,000	19,200

These or similar streams may be made available directly by pipeline at the ATAS refinery in Mersin or at the refinery in Batman. At Mersin the available quantities of straight-run naphthas should be approximately 300,000 tons, and at Batman about 50,000 tons.

The above-specified unified light naphtha stream can supply a plant that would yield 240 tons of ammonia per day. For process fuel, a plant of this size will require 5.3 barrels of fuel oil per ton of ammonia. The estimated ammonia plant cost would be about TL 90 million ($10 million). Another TL 54 million ($6 million) would be required for facilities to produce ammonium nitrate and/or urea.

Technically, the naphtha streams are not the only ones available for nitrogen fixation. It may be possible to make suitable commercial arrangements to assure the supply of other product streams from one or more of the three refineries. Before construction of a processing plant, a guaranteed raw material source must be assured.

Hydrogen from Gases

The most common hydrogen source for synthesizing ammonia is natural gas. Turkey has little or no proven reserves of natural gas, but a detailed economic study may indicate that it would be less costly to import hydrogen-rich gases, such as LPG, rather than use the refinery product of crude oil imports. These gases may be readily available in countries near to Turkey.

Liquefied methane is an example of an ideal gas for ammonia synthesis. England and Japan are in the advanced stages of importing this material.

Alternate Nitrogen Source

It may be economic to import anhydrous ammonia. A plant using this as a raw material to produce 50,000 to 70,000 tons of ammonium nitrate would cost about TL 18 million ($2 million). However, such a project would require annual expenditures of foreign exchange and import licensing for the raw material.

Phosphatic Fertilizers

Phosphorus is the second of the three principal elements necessary for adequate plant nutrition. Fertilizer production starts with phosphate rock and either treats the ground rock with an acid or charges the rock into an electric furnace to produce elemental phosphorus. The furnace phosphorus is then converted to phosphoric acid which, in turn, becomes the raw material for further phosphate chemistry.

Whereas there is a natural abundance of nitrogen, phosphates can only be produced from ore. This has yet to be developed in commercial quantities in Turkey. Present practice is to import the ore.

A limited amount of phosphate rock (20-36% P_2O_5) has been found in a cave near Bilecik in northwest Turkey. About 1,200 tons have been mined and utilized in the growing of sugar beets and other crops around Eskisehir. Additional phosphate ore may exist in other caves in this area, but they have not yet been explored. Also, an extensive deposit of phosphate ore near Gaziantep has been recently reported by the Mining Assistance Commission.

Turkey's present 262,000-ton annual capacity for phosphatic fertilizers consits of three plants: Karabuk, 22,000 tons; Yarimca, 120,000 tons; and Iskenderun, 120,000 tons. These plants have never operated at a capacity because of shortages of phosphate rock and sulfuric acid. Additional capacity proposed at Karabuk, Izmir, and Samson should be held in abeyance until domestic raw material sources have been developed.

Karabuk Superphosphate Facility

The superphosphate installation at the Karabuk steel mill has a capacity of 22,000 tons per year and is incidental to the steelmaking operation. The steel plant operates a sulfuric

acid unit where, among other outlets, the product is used for the separation of gaseous ammonia from the coke oven gases and for acidulation of phosphate rock.

The superphosphate facility uses imported rock and sulfuric acid produced from both pyrite and residues from the sulfur mining operation at Keciborlu. The quantities of raw materials and finished products for the past 5 years are as follows:

	Tons		
	Sulfuric Acid	Phosphate Rock	Normal Superphosphate
1957	6,184	7,555	12,037
1958	2,551	3,070	5,129
1959	6,930	8,417	14,048
1960	5,718	6,838	11,548
1961	5,043	5,236	9,481

Yarimca Superphosphate Plant

The plant at Yarimca is primarily a normal superphosphate unit having a capacity of 120,000 tons per year. It is equipped to manufacture powdered run-of-pile superphosphate having an available P_2O_5 content of about 16%. The word "normal" is used to identify superphosphate with a 16% available P_2O_5 content. When the availability is about 46%, the product is called a triple superphosphate and over 46%, concentrated superphosphate. The existing Yarimca plant is not capable either of manufacturing the triple or the concentrated forms without extensive alterations.

Present equipment includes a 20-25-ton-per-hour Broadfield acidulator, and storage areas for 5,000 tons of rock and 8,000 tons of finished product. There are no sulfuric acid production facilities. All the acid is purchased locally or is imported. This year the Yarimca plant plans to import 30,000 tons of rock and 17,000 tons of acid.

At present sulfuric acid (97-98%) is being imported from Montecatini, Italy, at a cost of TL 337 per ton cif. This is exempt from the 1% custom duty and the 18% sales tax. Some time in 1962 sulfuric acid (90-92%) from Murgul is expected to be received at the rate of 35,000 tons per year and at a cost of TL 200 per ton fob. Freight charges are TL 42 per ton to Yarimca with a differential of TL +2 or -2 per ton for annual deliveries below or above 35,000 tons.

The phosphate rock (about 30% P_2O_5) is imported from Gafsa, Tunisia. The price is TL 72 to TL 81 per ton fob., and the cif price is TL 117 per ton. The port charge is TL 9 per ton and the unloading cost TL 6 per ton. To save the port charge a new pier to cost TL 2 million is being considered at the plant site.

The import price of normal 16% superphosphate in this area is TL 225 per ton cif, and it retails for TL 380.

Iskenderun Superphosphate Plant

The Iskenderun plant has an installation similar to that at Yarimca. Its capacity is also 120,000 tons per year of normal superphosphate. The only difference is the addition of a granulator in the Iskenderun unit. The granulator was not in operation because of the difficulty in producing a suitable granule without auxiliary recycle and grinding facilities.

At present both the phosphate rock and the sulfuric acid are being imported. The rock used is either from Safi, Morocco, or Gafsa, Tunisia; its cif cost is TL 115 to TL 129 per ton. The rock is unloaded at Iskenderun at a cost of TL 15 per ton, and trucked 10 kilometers to the plant. The present acid supply is imported from Montecatini, Italy, as 66° Be acid at a cif cost of TL 293 per ton. In the future the plant expects to receive Murgul acid by tanker at a freight cost of

TL 75 per ton. It is hoped to use the NATO pier adjacent to the plant site for u: ' ıding the acid for direct pumping to the plant.

The process mixture used is 625 kilograms of 65 to 70% rock and 375 kilograms of 66° Be sulfuric acid, diluted to 58° Be for the process. Grinding capacity is 8.5 tons per hour on Moroccan rock and 10.5 tons per hour on Tunisian rock. The rich Moroccan rock is preferred, but the long grinding time required because of its greater hardness limits its use. They are producing their own Diesel electric power at about 40 kurus per kilowatt-hour.

The 1962 program is to produce 40,000 tons of product. However, for the year to date (May 10, 1962) they had produced only 2,723 tons of product. The product (14 to 16% P_2O_5) is priced at TL 300 per ton, fob. plant. The main competition is good granulated Dutch superphosphate (18-20% P_2O_5) that sells for about TL 400 per ton. One of their problems is storage, which is limited to 6,500 tons of raw rock and 6,500 of bagged product. Sales promotional activity could ease this situation by encouraging off-season purchases and storage by consumers.

Exploration

When the sulfuric acid plant at Murgul goes on full production it will provide a domestic source for this raw material. The discovery and development of phosphate deposits are the principal problem in increasing domestic production of phosphate fertilizers. The Turkish Mining Assistance Commission (MAC) is active in the search for this rock. The Commission has obtained data from the analysis of 1,468 sludge samples obtained from the Turkish Petroleum Commission's sample library of drill cuttings saved from six drill holes made for petroleum exploration. One sample contained 13.8% P_2O_5; two contained 9-10% P_2O_5; one, 7-8% P_2O_5; three, 6-7% P_2O_5; nine, 4-5% P_2O_5;

18, 3-4% P_2O_5; and 105 samples contained 2-3% P_2O_5. Geologists have recently located, based on the geological structure of the region of the phosphate-containing samples, an extensive phosphate deposit in southeastern Turkey near Gaziantep.

With these reserves Turkey can initiate plans to make phosphoric acid, the prerequisite for ammonium phosphate, as well as a host of phosphatic compounds. The discovery will also permit better production planning of the superphosphate facilities.

Ammonium Phosphate

The manufacture of ammonium phosphate is not recommended because the capital cost is high and Turkey's fertilizer needs can be satisfied by the simpler compounds during the near future.

Potassium Fertilizers

Potassium is the third of the three chemicals necessary for agricultural growth. It is found as a salt, generally among several other salts. The most economical source is the salt deposit where extraction can be performed with normal mining methods. At present, there are no known operating deposits in Turkey.

Potassium salts are also found in sea and salt lake waters. Here the concentration of the potassium salt is small compared to that of sodium chloride. In some bodies of water the total salt concentration is much higher than others, for example, the Dead Sea as compared to the Mediterranean. Where this occurs, less water has to be removed before salt separation is undertaken.

Where salt is extracted from water bodies, the initial evaporation is accomplished in solar pans consisting of large, shallow earth excavations. Turkey has two such facilities: one at Camalti; the other at Salt Lake. When the sodium chloride

crystals precipitate, the liquors are returned to the sea or the lake. These liquors or bitterns are generally a less desirable source of potassium salt than a salt mine from the standpoint of technical and economic feasibility.

Camalti Salt Plant

The plant at Camalti, near Izmir, under favorable climatic conditions, can presently yield up to 350,000 tons per year of unrefined sodium chloride. This operating plant, in addition to the crude crystal, is equipped to produce 15 tons of table salt and 25 tons of kitchen salt per day, and 4 tons of compressed salt per hour.

The plant operates for 5 summer months from June to October. About 17 square kilometers are used to evaporate sea water from 3.5-4.0° to 23-25° Be. The liquors are then transferred to an area of 3 square kilometers for crystallization and collection in 225 basins. The bitterns returned to the sea have the following analysis:

Salt	Grams per Litre	Per Cent
NaCl	178.5	50.2
KCl	20.3	5.7
$MgCl_2$	92.5	26.0
$MgSO_4$	64.6	18.1
$MgBr_2$	0.01	-
Total	355.91	100.0

If a plant to crystallize fractionally the above salts were to be constructed at Camalti, it could separate up to 10,000 tons of potassium chloride (KCl) annually at the present throughput capability of the main saltworks. The classical process using dolomitic lime would require the removal of magnesium prior to the production of the potassium chloride. A

plant of this size would cost about TL 45-63 million.

The Salt Lake Facility

A sodium chloride recovery operation is being carried on at Salt Lake in the central part of Turkey. About 150,000 tons per year of NaCl are recovered. This area may be found to be ideal geologically as a starting point in the search for potassium-rich salt strata. Core drilling the area may provide enough information to establish the existence of the desired salt.

German and American Experience

A limited review of the German and American experience will point up the reason for recommending exploration rather than bittern separation.

The extensive Stassfurt deposits in Germany are said to contain enough potassium salts to last the world thousands of years. The anhydrous Kainite and Schonite ($KCl-MgSO_4$ and $MgSO_4-K_2SO_4$) are treated with HCl to precipitate the KCl crystals. These deposits are the oldest source of commercial potassium salts.

Sylvinite (42.7% KCl, 56.6% NaCl) from the deposits of west Texas and southeast New Mexico, is the raw material for 85% of the potassium salts produced in the United States. KCl may be recovered from sylvinite by fractional crystallization or by flotation with tallow amine and polyalkylglycol.

KCl is also recovered from Searles Lake (California) brine by mixing with soda products, mother liquor, and borax liquors. A 97% purity KCl is produced. A plant near Salerno, Utah, recovers KCl from other brine by solar evaporation. A natural 1% KCl brine is concentrated to 30% in ponds. The crystalline product is then processed to 95% purity by flotation.

Other Sources

Other sources of potassium salts should be investigated. One is the cement kiln flue dusts, another, the blast furnace operation at Karabuk, and a third, molasses and sugar beet residues. Electrostatic precipitators are generally used in the recovery of potassium salts from the first two. It may be that the amount available from these sources is negligible or that the cost of recovery is prohibitive. Nevertheless, these sources should be investigated. It is suggested that the Mining Assistance Commission undertake this study as soon as possible.

Another and perhaps more important search could be based on aid from the petroleum companies. Where they have encountered sodium chloride during drilling and have made gamma logs, they may be able to interpret the readings for the possible existence of potassium salts.

INSECTICIDES AND FUNGICIDES

Where one class of chemicals, the nitrogen-phosphorus-potassium compounds promotes plant growth, another class of chemicals protects the plant from both insect and fungus destruction. Both classes of chemicals help to increase the over-all agricultural production.

Turkey presently has four companies compounding and packaging insecticides and one equipped to produce a fungicide, copper sulfate. They are located in the Istanbul area. Their present practice is to import the active ingredients such as DDT and BHC. These active ingredients are then mixed with inert fillers or carriers and sold for direct application.

The field trips of the Engineers included a typical insecticide plant, Agro-Merck; a manufacturer that was buying equipment for insecticide synthesis, Koruma; and a fungicide plant, the Rabak copper sulfate plant.

Agro-Merck

The plant, built in 1957, is 50% Turkish- and 50% German-owned. Of the total of 120 employes, 10 are technically trained.

Products of the plant are herbicides and insecticides. Imported chemicals include DDT, Lindane, BHC, and Toxophane. For the inert ingredients they process 5 tons per hour of materials, including clay, kieselguhr, talc, and sand. After formulation, their products are tested both in Turkey and in Germany.

Negotiations are in process with Union Carbide Corporation for formulations of their products for distribution in the Middle East.

The present production capacity is:

	Tons per Day
Dusting Products	100
Liquid Products	15
Anti-fungas Seed Dressing	15
Wettable Powder	25

Preparations are now being made to produce the various emulsion concentrates and agricultural mercurials. Their future plans include the installation of a BHC plant.

Koruma

Koruma currently formulates insecticides in the Istanbul-Maltepe area. Plans for a new caustic-DDT-BHC plant are at an advanced stage, and 140,000 square meters of land have been purchased in the vicinity of Derince-Izmit. Letters of credit have been established in favor of the following suppliers: Oronzio de Nora of Italy, W.J. Fraser of England, and J.R. Geigy of Switzerland.

Their financial sources are as follows:

Approved Development Loan Fund (AID) Credit	TL 25,200,000
Intended Italian and Turkish Credit	4,500,000
Equity in Local Currency (approx.)	20,000,000
Total	49,700,000

The estimated completion date is December 1963. The products and capacities are as follows:

	Tons per Year
Caustic Soda (100% basis)	10,200
Chlorine Gas	9,000
Hydrogen Gas	280
Sodium Hypochlorite	10,000
DDT Plant	3,000
BHC Plant (Tech. Grade only)	3,000
PDB Plant	350
Sulfuric Acid	9,000
Sulfuric Acid (By-product)	6,000
Hydrochloric Acid	6,000

Only about 8% of the caustic soda will be consumed by their own plant; the remainder, about 9,400 tons per year, will be available for sale. About 8,000 tons per year of the chlorine are required in their operations, but by adding cells they can increase their capacity by 50%.

Their main raw material, salt, will come from Camalti, close to Izmir. Their benzene will come from Karabuk and Eregli. Karabuk has agreed to produce benzene of the quality required for DDT and BHC manufacture. Koruma will manufacture the chloral hydrate and monochlorobenzene required for DDT production.

Their expected power cost is 11 kurus per kilowatt-hour. At present they have no outlet for their hydrogen production.

Rabak

One of the more important fungicides is the Bordeaux mixture, a combination of copper sulfate and lime. There are facilities to produce copper sulfate at the Rabak Elektrolitik Bakier Mamullier in Istanbul. The lime for the mixture is a readily available material.

The Rabak plant was originally designed and built for electrolytic copper production. Recently, a new section for the annual production of 1,500 tons of copper sulfate was added. The facility was put into operation and trial runs were made, after which the plant was shut down because its product cost was found to be higher than the import price of copper sulfate.

The management explained that even after the Government waived the various taxes on blister copper and sulfuric acid, the product price was still above the import price.

The demand for copper sulfate in Turkey is approximately 1,200 tons per year. During the first half of 1962, about TL 900,000 worth of sulfate had already been imported and offered for sale at TL 3.5 per kilogram.

ROOT NODULE BACTERIA

The Ministry of Agriculture's Soil and Fertilizer Research Institute is actively and intelligently pursuing research in the root nodule field.

This project consists of preparing root nodule bacteria for innoculating legume seeds prior to planting. This has been practiced for many years in the United States and has been extended to other groups of food plants. These root nodule bacteria fix atmospheric nitrogen into nitrogenous compounds which can be assimilated by the plant. They act as a fertilizer as the plant grows and also replenish some of the nitrogenous materials in the soil.

The immediate program is concerned with the isolation and selection of strains of these bacteria for high fixative potentials. The use of indigenous soils as a source of isolates is an excellent approach since it should assure a maximum number of phage-resistant strains. Use of strains from the United States or elsewhere would have only an even chance of success since these imported strains might be susceptible to the bacteriophages present in the Turkish soil.

An Institute staff member has been in the United States studying ways and means of producing these root nodule bacteria commercially. He will return to Turkey in the near future. The Director of the Institute intends to pursue not only the research but also the actual production of root nodule bacteria in commercial quantities.

MANAGEMENT PROBLEMS

Personnel

Personnel problems vary in the four plants which comprise Turkey's fertilizer industry. The State-owned nitrogen plant at Kutahya has an excess of manpower. This facility, which recently began operations, appears to be designed and laid out so that more workers are required than called for by good practice. At the superphosphate plant which is part of the Government-owned Karabuk iron and steel complex, the usual burden associated with Government enterprises is not in evidence. At the two Gubre Fabrikalari superphosphate plants, at Yarimca and Iskenderun, whose ownership is quasi-private, overmanning is not existent.

Difficulties are being experienced in attracting or keeping competent middle management employes, such as engineers, technicians, or foremen. This is due in large part to the low wages paid. For salaried personnel in Government enterprises, the maximum base salary established by law is TL 2,400 per month. Even with numerous fringe benefits and assured job security, this ceiling is not high enough to be attractive to qualified persons who can earn more with private concerns. Then too, this limit to wages results in situations where employes with varying degrees of competence and job responsibility are paid the same amount. Consequently, initiative and worker morale can be a serious problem. The need for technical assistance is most evident at the Azot plant where considerable difficulty has been experienced in recruiting the required skills.

The wages of hourly workers in the public enterprises are established by management and reflect the ceilings placed on the salaries of management itself. Generally, the same skills in the Private Sector of the economy command higher wages than in the Public Sector. Consequently, workers whose know-how may have

been obtained at public expense are often tempted to leave public employment for the opportunity of higher earnings in private industry. Although there is no private fertilizer industry as such, workers may be attracted to other private companies if their individual skills are in demand. The Gubre Fabrikalari management has some leeway in worker compensation matters and has been able to attract an adequate number of competent employes. No serious personnel problems are reported there.

On-the-job training is looked upon as a necessity and the hiring of untrained workers, who can acquire the necessary skills while working, is commonplace. The average worker is industrious and displays a great deal of ingenuity and aptitude. However, in those areas of public employment, where there are too many workers on the payroll and wage increases are earned by longevity and not accomplishment, the desire to work is weakened and the incentive to learn new skills and advance in position by actual achievement is greatly impaired.

The normal work week consists of 48 hours, with workers being paid for 56 hours. Bonuses in the form of extra pay may also be given as is the case at Karabuk where the equivalent of 2 months' extra earnings is paid to all employes. Fringe benefits are numerous and varied and may include free lunches, work clothes, transportation to and from work, housing, sick benefits, and allotments for children of workers. Generally, there are fewer fringe benefits for salaried people than for hourly wage earners.

Government Regulations

The private businessman in Turkey must cope with Government in several areas. The Government-owned industries offer direct competition in the manufacture and sale of products. The Government has on the books laws and taxes that severely hamper the growth of industry. There is no intent to frustrate business

but established classifications and interpretations of the law have this result.

The more important laws that affect business in Turkey are:

1. Production Tax Law
2. Income Tax Law
3. Corporation Tax Law
4. Fiscal Procedure Law
5. Labor Law

Production Tax Law

The Expenditure Tax Law 6802, enacted July 13, 1956, came into force on March 1, 1957, and amended by Law 210, dated January 7, 1961, provides for a tax on certain items manufactured or imported into Turkey. This tax is known as Expenditure Tax, Production Tax, Output Tax, Outlay Tax, or Transaction Tax.

At present there is no Production Tax on domestically produced fertilizers. Further, there are no customs duties on imported fertilizers, and consequently there is no Production Tax on the imported product. The Harbor Tax, which does apply to imported fertilizers, is economically unimportant.

Income Tax Law

Income Tax Law 193, dated January 3, 1961, provides tax liability for individuals and those business undertakings which are not considered corporations, as provided for in Corporation Tax Law 5422, dated June 7, 1949 and amended by Law 192, dated December 31, 1960.

Income tax is levied at the following rates:

Portion of Income		% Rate
On the first TL	2,500	10
On the next	7,500	20
On the next	15,000	30
On the next	30,000	40
On the next	70,000	50
On the next	157,000	60
On the next	217,500	70
Income of	500,000 and over	60

The law provides for a minimum cost-of-living allowance based on marital and dependent status which does not go beyond the 10% bracket above.

Employers in general, including corporations, are responsible for making deductions from employes' earnings and reporting same in the month following, in a statement of salaries, together with a statement of profit and income, to the proper taxation office.

A possible deterrent to investment is that the Income Tax Law provides for a Declaration of Wealth to be filed annually with the Declaration of Profits. Turkey had experience with this phase of information reporting in 1942 when a 100% tax levy on capital of all minority group businessmen was collected. The current law appears to be for purposes of auditing the correctness of the income tax payments; there has been no indication to date that a tax levy may be imposed. It has also been reported that this law has caused a flight of capital from banks to avoid revealing this indication of wealth.

Corporation Tax Law

Corporation Tax Law 5422, dated June 7, 1949, and amended by Corporation Tax Amendment Law 192, dated December 31, 1960, levies corporation tax upon fertilizer manufacturing establishments in the following corporate areas:

1. Association of capital
2. Co-operative societies
3. Public establishments having an economic purpose
4. Economic undertakings belonging to societies, endowments, and "Vakifs" (charitable funds)
5. Economic establishment belonging to foreign powers and corporation.

Corporation Tax is collected on net profits before taxes at the rate of 20% from associations of capital and co-operative societies and 35% from all other corporations.

Income Tax Law 193, dated January 3, 1961, Section 105, provides for an additional 20% of the net corporation profits from associations of capital and co-operative societies. This is to be withheld from corporation profits on the presumption that the residual profits of the corporation will be distributed to the shareholders as dividends. The withheld amount is later credited to the income tax of the individual shareholder.

The Turkish Government has been discussing for some time an allowance for reinvestment of net profit after corporation tax but before the 20% calculation for withholding for the account of shareholders' dividends. To date nothing has been decided.

Fiscal Procedure Law

Fiscal Procedure Law 213, dated January 4, 1961, provides for the procedure for collection of taxes and dues included in the General Budget, with certain exceptions, and for taxes, dues, and charges collected by the special administrations of the provinces and municipalities. Taxes and duties collected by the Administrations of Customs and Monopolies are not ruled by this law.

The major sections of the Fiscal Procedure Law are:

1. Imposition - covering general principles, methods of taxation and rating, notifications and examinations.

2. Duties of Taxpayer - covering notice, bookkeeping, vouchers, sowing statement, tax book, and records.

3. Valuation - covering economic assets, fiscal values, and depreciation write-off.

4. Penalty clauses - covering general principles, fiscal fines, imposition, payment, and cancellation of fiscal fines.

5. Fiscal disputes - covering opposition, appeal, and schedule for fines for irregularity.

Labor Law

Labor Law 3008, dated June 8, 1936, as amended through December 1958, is available in the English language in U.S. Department of Commerce, World Trade Information Service Bulletin No. 59-19, Part 1. Some of the more important features follow:

1. Applicability - "Undertakings" with 4 or more employes in cities of more than 50,000 population; in cities of less than 50,000 population, undertakings with 10 or more employes. (Certain exemptions from the terms of this act are not applicable to the industry covered in this report.)

2. Employment Contract - May be verbal for temporary employment, required to be written for permanent employment.

3. Hours of work - Generally 48-hour work week, a 5-1/2-day week, and 9-hour day. Overtime is restricted and 1-day rest per week is usual.

4. Child Labor - Under certain conditions, children at age 12 may commence work and receive between 50% and 75% of the wage paid to adults for similar work.

5. Termination of Employment - Severe indemnities are encountered by employers where employes with even a small tenure of service are dismissed or laid off.

6. 1960 Constitution - Provides for the right to strike and collective bargaining, not permitted in previous labor laws. The law to implement this constitutional provision has not been enacted at this date.

7. Minimum Wages - Have been established in many areas of Turkey, covering child labor as well as adult labor. Male and female workers receive the same wages for the same work performed.

8. Vacation and Holidays - Turkey has 13-1/2 legal holidays for which employers must pay one half a day's wages. Vacation, with pay, is the usual practice.

9. Fringe Benefits - These may include:

   a. Bonuses, at intervals

   b. Allowances for housing, family, clothing, and transportation

   c. Free lunches

   d. Hospitalization

   e. Retirement benefits.

Other Taxes Affecting Industry

There are numerous other taxes on industry. However, these generally represent a small financial burden. They include, local taxes on land and buildings; taxes for economic crises and defense; occupation and rental taxes; local improvement assessments; building licenses; stamp tax; and legalization fees. The prospective foreign investor should investigate thoroughly the entire Turkish tax structure in making a plant feasibility study.

Communication

The telephone system in Turkey is controlled and operated by the Government. If a phone is secured the system in Turkey does not provide even the minimum service necessary for an active business community. It is understood that improvements in the service are being studied. Communication is very important to a new industry or a new plant of an established industry. This is one area where a progressive attitude by the Turkish Government could have a direct effect on industry and reach a wide segment of the population by assuming the responsibility for the service

it controls by legislation. The practice of charging for telephone service when no service is rendered should be discontinued.

Power

Electric power utilities in Turkey are Government-owned-and-operated. Power is available in all present industrial areas. Generating capacity and high-voltage transmission are adequate. Local municipal service is poor with voltage variance common and interruptions frequent and of long duration. For new or additional service the user must furnish the transformer and possibly the cables to the transformer. Assurances by the Government that power requirements for possible future industrial expansion will be met are believed reliable. Projects with extraordinary power requirements would require detailed investigation as to availability and cost. Exhibit No. 2 is a map of Turkey showing the location of present and planned power lines and stations.

FOREIGN INVESTMENT

Foreign Investment Encouragement Law

Turkey made a progressive step in its attitude toward business when the Foreign Investment Encouragement Law 5821 and the revised law 6224 were enacted. However, in almost 11 years of operation, only TL 112 million (about $12 million) has been invested under their provisions. These are disappointing results for laws that are more liberal than those enacted by governments of other countries in the vicinity. In comparison with the Petroleum Law enacted in March 1954, foreign investment in Turkey by privately owned companies has been more than TL 1,690 million. In addition to this, more than TL 100 million in blocked currencies has been used. During this same time Turkish Petroleum Corporation has invested more than TL 500 million in exploration.

Early in 1961, Mr. Norman M. Littell of Washington, D.C., was commissioned to draft possible amendments to Law 6224, "in the hope of rendering more attractive the investment incentives in Turkey, to encourage private enterprise and capital from abroad, to contribute effectively and substantially to the economic recovery of Turkey upon resumption of constitutional government." Article 1 of the law sets the tone of the desire of the Turkish Government to improve the investment climate for foreign capital.

> "Article 1 This Law shall apply to the foreign capital imported into Turkey and to loans made from abroad by the decision of the Foreign Investment Encouragement Committee and the approval of the Council of Ministers provided that the enterprise in which the investment shall be made:
>
> a. Will tend to promote the economic development of the country,
>
> b. Will operate in a field of activity open to Turkish private enterprise,
>
> c. Will entail no monopoly or a special privilege."

Approval of investment application is, by law, made within 15 days, by the Council of Ministers, upon recommendation of the Foreign Investment Encouragement Committee. Appeal procedure is provided.

The law further provides for the unlimited transfer of all profits and capital investment at the option of the foreign investor, as well as the reinvestment of earnings in approved fields that promote the country's economic development.

The Turkish Government provides its guaranty, against security or bail, for an amount not exceeding TL 1 billion, of the principal and interest on a foreign loan to an enterprise fulfilling the requirements of Article 1 of this law.

While there is considerable foreign investment in Turkey not under the Foreign Investment Encouragement Law 6224, the amount is difficult to obtain. Therefore, this discussion is limited to those investments that have come into Turkey since August 1, 1951, under the close supervision of the Turkish Government provided for in Law 5821 and superseding Law 6224.

The liberal intent of these laws was overshadowed by the ominous political climate and Turkey's continuous deficit position in foreign exchange. An indication of the ineffectiveness of these liberal laws is shown in the following, obtained from the Foreign Investment Encouragement Program Office:

Foreign Investment as of February 20, 1962
(TL 000)

Industry	Approved Applications	Actual Investments	%
1. Food	42,086	14,209	34
2. Textile	139,070	5,427	4
3. Paper	1,055	18	2
4. Rubber	143,347	14,101	10
5. Chemical	142,003	19,411	14
6. Ceramic	10,483	7,089	68
7. Metalworking	10,989	7,293	66
8. Agricultural Machinery	14,230	6,000	42
9. Electrical Machinery	33,489	4,104	12
10. Miscellaneous	120,735	34,318	28
Total	657,487	111,970	17

Number of Projects - Approved	237	52%
- Rejected	212	47
- Under Study	6	1
	455	100%

Foreign investment in Turkey comes from 23 countries applying, 16 of which made actual investments. United States actual investment represents about 25%, West Germany 20%, Holland 19%, and Switzerland 16% of the total.

Foreign Investment Guaranty Programs

1. United States investors may be able to obtain United States Government guaranties for new investment in Turkey against:

   (a) Currency inconvertibility

   (b) Expropriation or confiscation
   (No guaranty is yet available against loss by reason of war.)

Types of investment covered -

(a) Establishment of a Turkish subsidiary, branch, or affiliate.

(b) Licensing a Turkish company to use Unites States patents or processes.

(c) Increasing investment in an existing Turkish venture. The cost to the investor is generally 1/2 of 1% per year of the guaranty coverage for each type of guaranty. The coverage is available for periods up to 20 years.

2. West Germany recently signed an investment guaranty treaty with the Turkish Government, details of which are not available as of this date.

EXHIBITS

EXHIBIT NO. 1

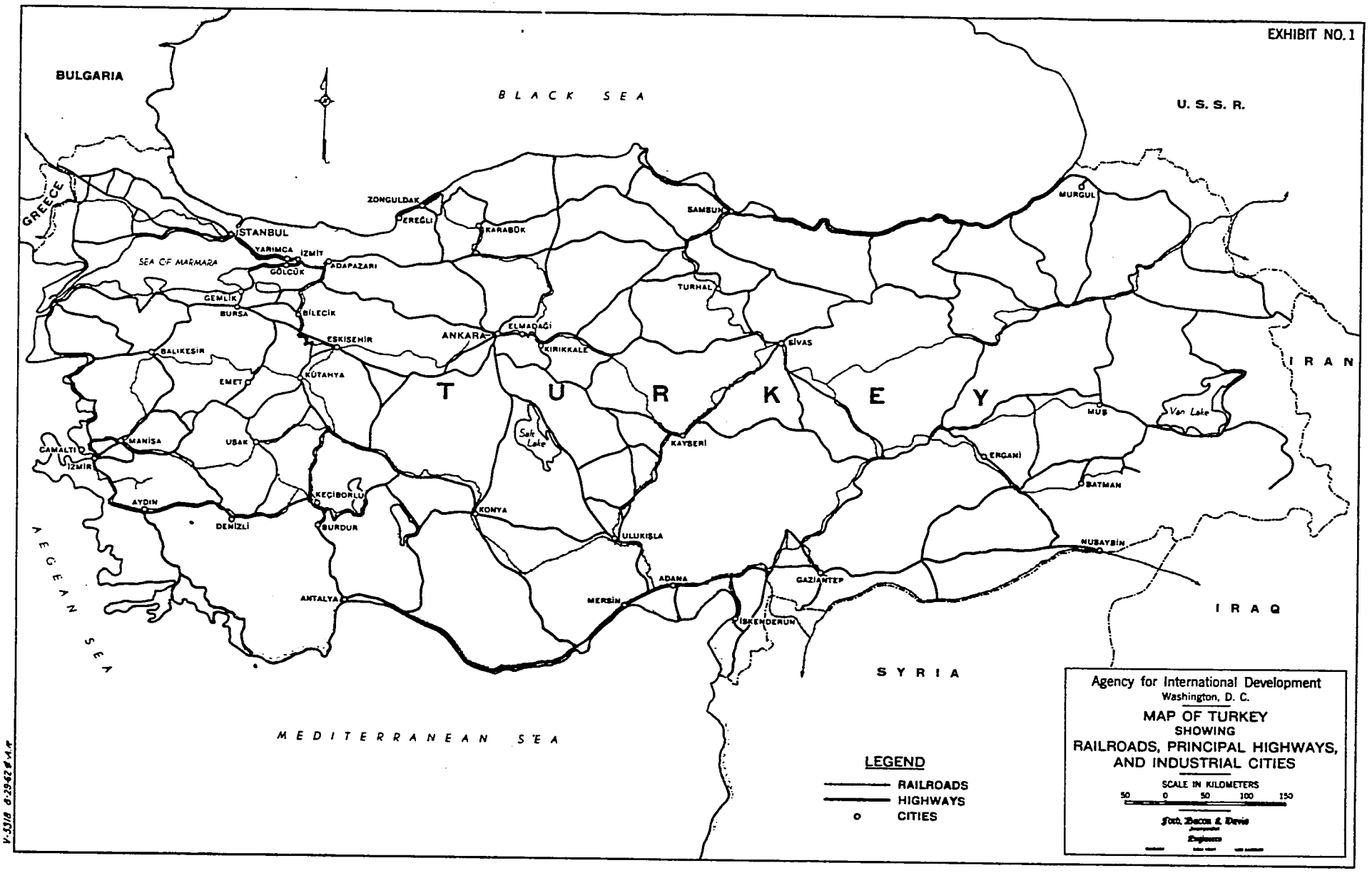

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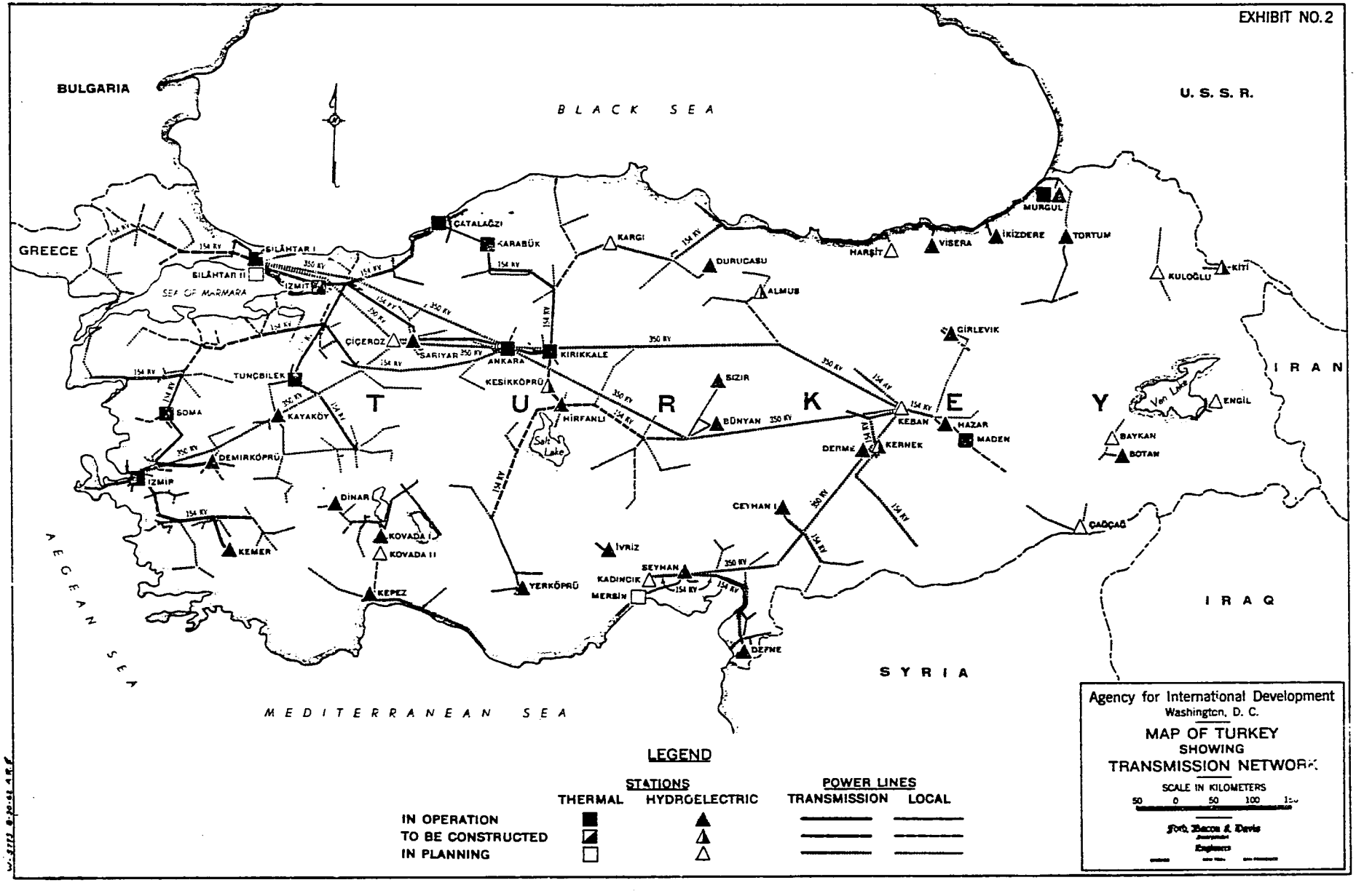
EXHIBIT NO. 2



LEGEND

	STATIONS THERMAL	STATIONS HYDROELECTRIC	POWER LINES TRANSMISSION	POWER LINES LOCAL
IN OPERATION	■	▲	———	———
TO BE CONSTRUCTED	◪	◭	———	———
IN PLANNING	□	△	———	———

Agency for International Development
Washington, D. C.

MAP OF TURKEY
SHOWING
TRANSMISSION NETWORK

SCALE IN KILOMETERS
50 0 50 100 150

Ford, Bacon & Davis
Engineers

51.