

26

**Profile of the  
Environmental Business Sector  
in Tunisia**

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# **Profile of the Environmental Business Sector in Tunisia**

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# *Contents*

## *Acronyms*

## *Introduction and Overview*

Overview of Tunisia's Environmental Situation	1
Principal Environmental Features in Tunisia	2

## *Business Opportunities in the Environmental Sector* 5

Sanitation	6
Energy Control	10
Solid Wastes	17
Measures to Combat Desertification	25
Drinking Water	29
Industrial Pollution Control	35
Water Resources	39

## *Entities Interviewed* 45

## *Acronyms*

AFH	Agence foncière d'habitation (Agency for Land and Housing)
AIC	Associations d'intérêt collectif (Associations of Collective Interest)
AME	Agence de maîtrise de l'énergie (Energy Control Agency)
AMTVD	Agence municipale du traitement et de valorisation des déchets (Municipal Agency for Waste Treatment and Recovery)
ANPE	Agence nationale de protection de l'environnement (National Environmental Agency)
API	Agence de promotion de l'industrie (Agency for the Promotion of Industry)
ARRU	Agence de réhabilitation et de rénovation urbaine (Urban Renovation and Development Agency)
BAD	Banque africaine de développement (African Development Bank)
BEI	Banque européenne d'investissement (European Investment Bank)
IBRD	International Bank for Reconstruction and Development
EEC	European Economic Community
CPSCL	Caisse des prêts et de soutien des collectivités locales (Fund for Loans and Support to Local Communities)
CRDA	Commissariat régional de développement agricole (Regional Commission for Agricultural Development)
FAO	Food Agriculture Organization
GEF	Global Environmental Facility
INNOPRI	Institut national de normalisation (National Standardization Institute)
KFW	Kreditanstalt für Wiederaufbau (Germany)
MDT	Millions of Tunisian dinars
NGO	Nongovernmental organization
ODESYOANO	Office de développement sylvo-pastoral du nord-ouest (Office for Development of Forest and Pasture Lands in the Northwest)
ODS	Office de développement du sud (Office for Development of the South)
ONAS	Office national d'assainissement (National Sanitation Office)
ONTT	Office national de tourisme tunisien (National Tunisian Tourism Office)
PANE	Programme d'action national d'environnement (National Environment Action Program)
PDR	Programme de développement rural (Rural Development Program)
PRONAGDES	Programme national de gestion des déchets solides SNCPA (National program for management of solid wastes)

<b>SNCPA</b>	<b>Société nationale de cellulose et de pâte d'alfa (National Cellulose and Esparto Pulp Corporation)</b>
<b>SNIT</b>	<b>Société nationale immobilière de Tunisie (Tunisian National Real Estate Company)</b>
<b>SONEDE</b>	<b>Société nationale de l'exploitation de distribution de l'eau (National Corporation for Water Use and Distribution)</b>
<b>STEG</b>	<b>Société Tunisienne de l'électricité et du gaz (Electricity and Gas Company of Tunisia)</b>

## *Introduction and Overview*

This profile describes opportunities for private sector development of environmental activities and services in Tunisia. It is one of a series supported by the Project in Development and the Environment (PRIDE) on environmental markets in Near East countries, including Tunisia, Morocco, Jordan, and Egypt. The conclusions of this profile are based on study of available materials on the environment in Tunisia and interviews with numerous sources actively involved in environmental issues.

### **Overview of Tunisia's Environmental Situation**

Since its independence in 1956, Tunisia has focused its economic development on three major sectors: agriculture, tourism, and industry. Today, development of these sectors poses a constantly growing threat to the environment. Tunisia is experiencing many of the environmental problems found in other developing countries:

- ▶ demands on fragile and limited natural resources
- ▶ rapid population growth in relation to its land mass and natural wealth
- ▶ urban explosion in all the cities and especially those on the coasts
- ▶ imbalance between needs expressed by the population and available infrastructure

The country also has many of the problems that have arisen in developed countries:

- ▶ industrial pollution
- ▶ urban pollution
- ▶ increase in traffic
- ▶ increase in consumption of waste-producing products that may harm the environment
- ▶ use of agricultural land for urban and tourist purposes

Tunisia has integrated environmental protection and quality of life improvements into its economic and social plans and development programs. Environmental protection and improved living conditions are principal components of the development policy initiated and implemented by the Tunisian government on November 7, 1987. Since then, the Tunisian

authorities have intensified their initiatives and actions designed to protect the country's environment and natural resources.

To accomplish this goal, institutional and administrative organization, legal and regulatory procedures, and budgetary allocations for managing natural resources and environmental protection have been greatly expanded over the past several years. Tunisia is committed to protecting its environment and to implementing policies of sustainable development.

**Principal  
Environmental  
Features  
in Tunisia**

Tunisia, with an estimated population of 9 million in 1993, confronts the following environmental problems:

- ▶ continuous deterioration of land resources caused by persistent erosion, desertification, urban development, and inadequate land use management
- ▶ deterioration of water resources through:
  - soil erosion which shortens reservoir life by reducing storage capacity (The resulting capacity loss of the 13 principal dams is estimated at 25 million cubic meters of water.)
  - water salination in some reservoirs and water tables (Cap Bon, Sahel, Mareth, South)
  - direct or indirect discharge of household and industrial wastewaters containing chemicals, industrial effluents, and solid wastes into the water tables and reservoirs. For example, most industries in the Medjerdah Valley discharge completely untreated liquid and solid wastes into the wadi.
- ▶ great risk to the quality of fresh water resources stemming from excessive demands on the water tables, salination of some of them, and increased use of urban, industrial, and agricultural pollution
- ▶ sometimes excessive use of coastal areas and regions
- ▶ deterioration of marine and coastal resources subjected to pollution and degradation, of which the following are the most important types:
  - hydrocarbons that threaten 1,300 km of coastline and derive principally from the heavy maritime traffic in the straits separating Tunisia and Sicily, offshore oil exploration, and port activities linked specifically to loading and unloading hydrocarbons
  - industrial activities
  - tourism and fishing

- ▶ deterioration of the quality of life, particularly in urban environments resulting from:
  - inadequate infrastructure to serve the population (relative to the need for services)
  - unregulated liquid and solid domestic and industrial urban waste
  - an alarming rate of continuous unplanned housing construction
  - the population's non-observance of municipal regulations for urban services management

To confront these problems, the Tunisian authorities have instituted many programs to improve living conditions and to protect the environment by attacking direct and indirect causes of the degradation. Emphasis is being placed on the following:

- ▶ water erosion and floods that cause yearly loss of about 11,000 hectares of productive land
- ▶ desertification that threatens about 5.5 million hectares and causes yearly loss of about 8,000 hectares of productive land
- ▶ scarcity of water and water pollution
- ▶ dumping of wastes into the sea
- ▶ absence of sanitary facilities in some urban neighborhoods
- ▶ excessive use of coastal land
- ▶ need to improve quality of life in urban areas
- ▶ urban waste management

To address the above national concerns, committees and think tanks have been created to coordinate the activities of the interested parties, identify measures to ensure environmental protection, set priorities, implement established measures, and assess accomplishments.

The committees are active in the following areas:

- ▶ protecting marine environment
- ▶ preserving and sustaining biological biodiversity
- ▶ protecting the atmosphere
- ▶ promoting an appropriate legislative and legal framework
- ▶ fighting industrial pollution
- ▶ managing specific wastes and anti-pollution funds
- ▶ improving efforts and programs designed to combat desertification
- ▶ managing hospital wastes
- ▶ managing quarries
- ▶ managing household waste and controlling public dumping
- ▶ following up on anti-pollution programs of large industrial entities

## *Business Opportunities in the Environmental Sector*

The best opportunities for investment in the environmental arena over the next five years (and beyond) are in areas that the government considers priorities. These have been either clearly defined in strategic programs already established and require implementation over several years or over periods covered by several five-year plans, or announced and established as part of the VIIIth Economic and Social Development Plan. In many cases, priorities are emphasized through intervention and creation of opportunities to participate in the environmental arena.

Clearly, the features of development depend on measures the government has taken to implement development plans. Such is the case for industrial pre-treatment (public and private), which can develop only if impact studies and pollution control efforts are monitored and implemented with commitment and continuity. Economic and political difficulties, such as municipal or other elections, frequently hinder enforcement of these measures.

The government and its agencies are, for the most part, still the chief contractor. The other players, drawn mostly from the private sector, work under government contracts, except for those in the industrial sector who represent less than 10 percent of opportunities in Tunisia today.

The Tunisian government has set priorities for protecting water resources, saving energy, improving conditions for tourists, and ensuring sanitation in the urban environment.

Water resources are particularly important in Tunisia. The Ministry of Agriculture will implement a national 10-year program designed to develop new water resources and a national program for protecting existing water resources over a timeframe that may exceed 10 years. Its implementation will involve many players including the Ministries of Agriculture, Environment and Land Use Planning, Public Health, and National Economics.

The prospects for energy resources, which form the basis of a 10-year plan for energy control emphasizing renewable energy development, are not encouraging.

In addition, the importance of tourism to the country's economy has required continuous efforts to improve the environment in the areas that tourists visit. This means thorough treatment of household and industrial wastewater discharged into the ocean through the wadis. The main component of the "green plan" initiated in the Sousse region is to eliminate discharge of non-treated water into four wadis feeding into the sea in the Sousse urban area.

Cleanliness and beautification are top priorities for municipalities. Concern for the environment has taken the form of a sustained national program involving the municipalities and all specialized players whose concerted activities can help improve quality of life through:

- ▶ cleaner cities
- ▶ proper household waste collection
- ▶ rational removal of solid wastes
- ▶ sanitation for cities without wastewater treatment systems
- ▶ improvement of infrastructures in neighborhoods with unplanned and/or housing not conducive to healthy living

These five programs, and another aimed at combatting desertification, will be added to the National Environment Action Program (PANE) [Programme d'action national d'environnement] which focuses on combatting industrial pollution. The PANE components dealing with sanitation and hygiene focus especially on the primary infrastructure needed to ensure that cities and neighborhoods are connected to the sanitation network.

To carry out these programs, many services must be developed, specifically those related to studies, guidance and project follow-up. The value of these services is about 10 percent to 15 percent of the total value of the projected programs.

### **Sanitation**

Sanitation is an important market in Tunisia. The sanitation sector includes these subsectors:

- ▶ sanitation master plan studies
- ▶ construction of treatment stations
- ▶ equipment for the treatment stations
- ▶ creation of networks (supply and laying of material)
- ▶ service connections
- ▶ network maintenance
- ▶ maintenance of treatment stations, discharge and pumping stations

Investments in sanitation by the main players in this sector over the last three years were as follows:

1990: 31.9 million dinars

1991: 37.8 million dinars  
1992: 47.0 million dinars

The main funding sources for the investments were the public budget, the World Bank, the KFW (German assistance), the EIB (European Investment Bank), the EEC, cooperation with Sweden, and USAID.

The Tunisian government's determination to pursue efforts in this area means that the sanitation sector will be one of the most important areas of environmental intervention over the next 10 years.

The development of sanitation networks and the increase in the number of cities entrusted to the responsibility of the ONAS (Office national d'assainissement) [National Sanitation Office] will, over the next 10 years, require large investments in sanitation service equipment to maintain and clean networks.

The many treatment stations and their widespread geographic distribution will require the building and equipping of many ONAS regional laboratories. Companies working in this sector for the ONAS fall into two categories: Tunisian companies working in civil engineering and piping supply, and foreign companies for certain types of work and equipment.

The current situation in the sanitation sector is expected to continue over the next few years. Those responsible for the sanitation sector are concerned by the lack of significant competition in the field. The supply of piping is already well covered by Tunisian companies, but the need for other furnishings offers excellent opportunities in this field. Opportunities exist for foreign companies in the sale and supply of services and equipment, such as:

- ▶ engineering studies
- ▶ laboratory instruments
- ▶ pumps
- ▶ electric motors
- ▶ station control systems
- ▶ water treatment stations
- ▶ network monitoring systems
- ▶ cleaning and purification equipment

Under the Government's policy of promoting the private sector, a large market is opening in sanitation facilities maintenance. Because ONAS wants to ensure good sanitation service and long life for its equipment, it will not allow polluting industries to connect to its network. For these industries to conform to standards in Tunisia for discharging wastes into the environment, pre-treatment of industrial water is one of the best solutions.

It is expected that the industries themselves will build and manage treatment stations serving several different industries.

## Products and Services

The sanitation sector has a great variety of products and services, the most important of which represent a potentially very profitable market:

- ▶ constructing and equipping treatment stations
- ▶ constructing and maintaining treatment networks
- ▶ conducting studies of master plans (feasibility studies, technical studies)
- ▶ constructing irrigation networks for the use of treated water
- ▶ equipping services with cleaning and maintenance material
- ▶ equipping laboratories responsible for monitoring water quality
- ▶ training ONAS personnel (many of whom are trained today through a cooperative arrangement with Germany)

### Evaluation of Opportunities in Water Resources

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	A	A	A	A
Opportunities for foreign companies	A	A	A	B	A
Opportunities for private Tunisian companies	A	A	B	B	A
Joint venture opportunities	A	A	B	B	B
Long-term markets	A	A	B	B	B
Expected level of competition	A	A	B	B	B
A: Excellent      C: Fair B: Good          D: Poor					

### *Potential Clients*

**Office national d'assainissement (ONAS):** for studies, construction of primary networks and treatment stations, network, and material maintenance

**Address:** Rue de la Monnaie 1002 Tunis, Belvédère

**Fax:** 350 411

**Tel:** 288 088

**Agence de réhabilitation et de rénovation urbaine (ARRU) [The Urban Renovation and Development Agency]:** for engineering studies and construction of secondary and tertiary networks

**Address:** 8 Rue Ibn Ehmadi 1080, Tunis

**Fax:** 794 923

**Tel:** 782 655

**Agence foncière d'habitation (AFH) [The Agency for Land and Housing]:** for engineering studies and construction of secondary and tertiary networks (and some primary networks)

**Address:** Rue 7050, (old Soukra Road)

**Fax:** 717 329

**Tel:** 717 433

**Real estate developers:** for engineering studies and construction of secondary and tertiary networks

**La Société nationale immobilière de Tunisie (SNIT) [The Tunisian National Real Estate Company],** one of the country's largest real estate developers)

**Address:** El Manar II - El Menzeh, Tunis

**Fax:** 767 464

**Tel:** 237 011

Foreign donors primarily fund the potential areas of intervention in sanitation and hygiene, which fall under public responsibility. The largest client, ONAS, is largely subsidized by the Government, but the sanitation fees it collects cover only its operating expenses. The Government finances all investments in infrastructure or material. It should be noted that the ONAS uses rainwater for part of its infrastructure and is responsible for maintenance and cleaning.

## Sanitation Projects

Projects	Investments (in millions of dinars)
<b>A. ONAS Projects</b>	53.3
1. Carrying through current projects including	
▶ completion of the wastewater elimination project in 41 cities	(28.6)
▶ sanitation project for greater Tunis	(8.1)
▶ Four Station Treatment Project	(7.5)
2. New projects including	85.4
▶ first and second sanitation project for working class neighborhoods	(19.6)
▶ expansion and rehabilitation of treatment stations	(29.9)
▶ construction of networks and treatment stations in 5 large cities	(16.6)
▶ construction of 15 pilot stations	(6.5)
3. Rain water drainage program designed to protect 17 cities against flooding	16.0
4. Various other projects including purchase of material	7.3
<b>B. API, AFI, AFH Projects</b>	
Construction of the sanitation network on housing lots and in tourist and industrial areas	52.0
<b>C. Local sanitation authorities in municipal and rural areas</b>	40.5
<b>D. Private</b>	
Rehabilitation of the North Tunis lake	20.0
Construction of septic tanks	24.0
<b>TOTAL</b>	<b>298.5</b>

## Energy Control

Planned energy control programs deal mainly with these sectors:

- ▶ industrial sector, especially building materials
- ▶ transportation sector: maintenance of motors and user training
- ▶ the residential and service sectors: household appliances,

solar and photovoltaic water heaters, improved *tabouna*

The main components of these programs are listed below:

- ▶ engineering studies
- ▶ acquisition of materials
- ▶ modification of the manufacturing process
- ▶ user training

Total AME investments (Agence de maîtrise de l'énergie) [Agency for Energy Control] over the last three years (excluding corporate investments) are indicated below in millions of Tunisian dinars.

Year	Local Component	Foreign Currency Component	Total
1989	210	789	999
1990	298	1,302	1,600
1991	433	1,307	1,740

Investments planned for this sector in the VIIIth Plan total 14.5 million Tunisian dinars.

The principal funding sources for investments in the energy control sector are:

- ▶ national Tunisian budget
- ▶ cooperation with Germany (PSE)
- ▶ cooperation with Belgium
- ▶ cooperation with the EEC
- ▶ IBRD loan
- ▶ cooperation with the United States
- ▶ cooperation with Spain
- ▶ technical cooperation with France

Companies currently involved in the energy control area fall into two categories:

- ▶ Tunisian companies for certain engineering studies
- ▶ foreign companies for certain engineering studies and for material

For foreign companies, opportunities exist in sales and supply of technical services and equipment:

- ▶ engineering studies
- ▶ sales of equipment
- ▶ development of monitoring systems
- ▶ sales of measuring equipment
- ▶ modification of manufacturing processes

The Government's private sector promotion initiative points toward an important market opening in the energy control sector.

### *Products and Services*

Energy control sector products and services take many forms. The most important, representing a promising market, are indicated below:

- ▶ engineering studies and equipment designed to save energy in the cement sector
- ▶ engineering studies and equipment designed to save energy in the cellulose and esparto pulp sector
- ▶ engineering studies and equipment designed to save energy in the brick sector
- ▶ construction of diagnostic stations for vehicle motors
- ▶ a study designed to improve productivity of vehicles used for road cargo transportation by reducing the number of trips made without freight
- ▶ consciousness raising aimed at users and specifically focusing on:
  - introducing ideas for energy conservation into the driving test
  - drafting master plans for urban transportation
  - improving energy efficiency for residential appliances and equipment
- ▶ use of renewable energy:
  - use of photo-voltaics
  - use of improved *tabounas*
  - solar heating of water for domestic use
  - development of digesters for biogas production

## Evaluation of Opportunities in Energy Control

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	C	A	B	B
Opportunities for foreign companies	A	D	A	C	A
Opportunities for private Tunisian companies	A	B	B	A	C
Joint venture opportunities	A	C	A	B	B
Long-term markets	A	C	A	A	B
Expected level of competition	A	B	A	B	B
<b>A: Excellent      C: Fair</b> <b>B: Good          D: Poor</b>					

### *Potential Clients*

Agence de maîtrise de l'énergie (AME) for engineering studies and pilot project promotion

Address: 8, Rue Ibn El Jazzar 1002, Tunis le

Belvédère B.P. 2213

Fax: 784 624

Tel: 787 700

### **Industrial sector (public and private)**

Cement sector for introduction of precalcination units to improve specific energy consumption and the production capacity of three cement works:

Gabès cement

Address: 68 Avenue Farhat Hached, Tunis

Fax: 353 151

Tel: 347 177/345 177

**Bizerte cement**

Address: Rue Blida, Tunis

Fax: 342 194

Tel: 493 379

**West Jebel cement**

Address: 3, Rue Touraine, Tunis

Fax: 780 945

Tel: 894 745

**SNCPA (Société nationale de cellulose et de pâte d'alfa) [National Cellulose and Esparto Pulp Corporation]**

Address: 6, Avenue Habib Bourguiba, Tunis

Fax: 342 985

Tel: 349 633

Brick sector: modifications of large-scale brickworks

**Transportation sector**

Ministry of Transportation: for engineering studies and construction of motor vehicle diagnostic stations and introducing energy saving ideas to the driving test

Address: 3 bis, Rue d'Angleterre, Tunis

Fax: 790 149

Tel: 682 194

Road cargo transportation companies (public and private)

Municipalities (Ministry of the Interior) for review of urban transportation master plans for the major cities (Tunis, Sfax, Sousse, Gabès, Bizerte) Direction Générale des collectivités publiques [General Directorate for Local Public Communities] responsible for municipalities follows:

Address: Rue El Moaskar

Fax: 350 309

Tel: 354 904

**Residential and service sector**

INNOPRI, (Institut national de normalisation) [National Standardization Institute] for setting standards

Address: 10 bis, Rue Ibn El Jazzar

Fax: 781 563

Tel: 785 922/784 563

STFC (Société Tunisienne de l'électricité et du gaz) [Electricity and Gas Company of Tunisia], for distribution of photovoltaics and solar water heaters

Address: 38, Rue Kemal Atatürk, 1001 Tunis

Fax: 349 981

Tel: 243 122/341 311

Forest and Pasture Land Development Office for the Northwest (ODESYOANO: Office de développement sylvo-pastoral du nord-ouest) [Office for Development of Forest and Pasture Lands in the Northwest] and PDR (Programme de développement rural) [Rural Development Program] for distribution of improved *tabounas* and digesters for biogas production

Address: Route de Tunis 9000 Béja

Fax: (08) 51 718

Tel: (08) 50 500

The following ministries may be clients for photovoltaics and solar water heaters:

Ministry of Education and Sciences: for lycées and other schools

Address: Boulevard Bab Benat 1006

Fax: 786 711

Tel: 286 300/660 800/660 637

Ministry of Public Health: for hospitals and clinics

Address: Place Bab Sâadoun, Tunis 1001

Fax: 567 100

Tel: 662 181

Ministry of Tourism and Handicrafts (incentives for hotels)

Address: Avenue Habib Bourguiba, Tunis

Fax: 350 997

Tel: 341 077

Ministry of Agriculture: for CRDA (Commissariat régional de développement agricole) [Regional Commission for Agricultural Development]

Address: 30, Rue Alain Savary 1002, Tunis le Belvédère

Fax: 890.824

Tel: 680 088

Ministry of Finance: for customs stations and receivables

Address: Place de la Kasbah

Fax: 563 959

Tel: 661 218

**Demand Expressed Through Projects Scheduled Over the Next Ten Years**  
(in millions of Tunisian dinars)

<b>Projects</b>	<b>Investment</b>
<b>Industrial Sector</b>	
1. Energy savings in the cement sector	18.5
2. Energy savings for SNCPA	5.5
3. Energy savings in the brick sector	5.0
Subtotal for industrial sector	29.0
<b>Transportation Sector</b>	
4. Motor vehicle diagnostic stations	11.2
5. Reducing trips with no cargo (freight stations)	0.4
6. Passenger transportation master plan	1.0
7. Introducing ideas on energy conservation into the driving test	2.0
Subtotal transportation sector	14.6
<b>Residential and Service Sector</b>	
8. Energy efficiency for residential sector appliances and other equipment	0.7
9. Distribution of improved <i>tabounas</i>	11.5
10. Solar heating of water for domestic use	47.5
11. Distribution of digesters for biogas production	28.0
12. Photovoltaic distribution	27.0
Subtotal for residential and service sectors	114.7
<b>Grand Total</b>	<b>158.3</b>

## **Solid Wastes**

The solid waste sector includes:

- ▶ studies of master plans to collect and remove household wastes
- ▶ municipal collection equipment
- ▶ construction of treatment stations (controlled dumping, incineration and compost preparation)
- ▶ household waste collection
- ▶ maintenance of treatment stations
- ▶ management of controlled dumping
- ▶ industrial waste collection and treatment
- ▶ hazardous waste collection and treatment

Despite efforts of local authorities in the area of hygiene to correct deficiencies, the solid waste problem has not been resolved. The Ministry of the Environment and Land Use Planning has granted top priority to the establishment of a rational program for managing solid wastes (PRONAGDES) [Programme national de gestion des déchets solides] which will concentrate on:

- ▶ 1.2 million tons per year of household wastes broken down as follows:

- 70% organic matter
- 10% paper
- 10% plastic
- 5% metal
- 2% glass
- 3% other

- ▶ 2000 tons per year of septic wastes
- ▶ 25,000 tons per year of used tires
- ▶ 60,000 tons per year of waste from poultry
- ▶ 300,000 batteries per year

The above figures must be added to solid wastes from mines in the Gafsa, Sfax, and Gabès regions.

The Ministry of the Interior, which established the National Program for Hygiene and Environmental Protection, and is responsible for implementation and follow-up, has taken steps to improve hygiene in the cities and to beautify the cities. The program is encouraging 246 cities to modernize and develop equipment and management techniques for dealing with wastes.

Investments in the sector for purchase of cleaning equipment over the last three years are indicated below:

1990: 3 million Tunisian dinars  
1991: 4 million Tunisian dinars  
1992: 13 million Tunisian dinars (estimated)

The main funding sources for these investments are:

- ▶ the national Tunisian budget
- ▶ local budgets
- ▶ Caisse des prêts et de soutien des collectivités locales (CPSCL) [Fund for Loans and Support to Local Communities]
- ▶ loans and grants from bilateral cooperation (Germany, Italy, United States, Sweden)
- ▶ World Bank loans

The Tunisian government's commitment to continue expanding efforts in this field indicates that the solid waste sector will be one of the most important areas for environmental intervention over the next 10 years.

The types of companies operating in the area of solid wastes are listed below.

- ▶ Tunisian companies engaged in engineering projects, civil engineering and supply of material
- ▶ foreign companies for material
- ▶ municipalities for collection of household wastes
- ▶ Agence municipale du traitement et de valorisation des déchets (AMTVD) [Municipal Agency for Waste Treatment and Recovery]

Over the next several years, improvements are expected in the status of solid waste disposal and development of interventions in this area.

For foreign companies, opportunities exist in sales and supply of services and equipment, such as:

- ▶ engineering studies
- ▶ measuring and laboratory instruments
- ▶ transportation and compacting vehicles
- ▶ cleaning equipment for use on public roads
- ▶ solid waste recycling stations

The fact that the government focus is on encouraging the private sector points to the development of an important market for collecting and removing solid wastes, managing integrated household waste removal systems and collection, recycling, and storing industrial wastes. This focus will permit waste management without environmental damage.

## Products and Services

The most important products and services for the solid waste management sector representing a promising market, are listed below:

- ▶ studies of master plans to collect and remove urban household wastes (feasibility studies and technical studies including controlled discharge impact studies)
- ▶ training in solid waste management for personnel in municipalities and private companies
- ▶ management of controlled garbage dumping
- ▶ construction of equipment for recycling factories (paper, aluminum, glass, plastic)
- ▶ supplying municipalities with cleaning, transportation, and compost preparation equipment
- ▶ measuring and laboratory equipment
- ▶ equipment for incinerators in hospitals and clinics

### Evaluation of Opportunities in Solid Wastes

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	A	A	A	A
Opportunities for foreign companies	A	B	A	B	B
Opportunities for private Tunisian companies	A	A	C	B	C
Joint venture opportunities	B	B	B	B	B
Long-term markets	A	A	A	A	B
Expected level of competition	A	B	A	B	C
A: Excellent      C: Fair B: Good          D: Poor					

## *Potential Clients*

### **Ministry of the Interior**

**Address:** Avenue Habib Bourguiba 1000, Tunis

**Fax:** 351 888

**Tel:** 243 000

### **Ministry of the Environment and Land Use Planning**

**Address:** 32, Rue de la Monnaie, Tunis

**Fax:** 786 506

**Tel:** 343 200

**Municipalities (Ministry of the Interior):** for review of master plans for urban transportation in the major cities (Tunis, Sfax, Sousse, Gabès, Bizerte)

**Direction Générale des collectivités publiques [Management for Local Public Communities]:** responsible for municipalities

**Address:** Rue El Moaskar

**Fax:** 350 309

**Tel:** 354 904

**Individuals under contract to collect household wastes (and perhaps manage controlled or integrated dumping)**

### **Office national d'assainissement**

**Address:** Rue de la Monnaie 1002 Tunis, Belvédère

**Fax:** 350 411

**Tel:** 343 200

### **National Environmental Protection Agency**

**Address:** 12, Avenue Kherrddine Pacha 1002, Tunis Belvédère

**Fax:** 789 844

**Tel:** 799 201

### **Fund for Support to Local Communities**

**Address:** 8, Rue de Médina 1002, Tunis Belvédère

**Fax:** 797 467

**Tel:** 796 868

### **Hospitals and clinics**

**(Approximately 100 establishments)**

### **Manufacturers engaged in industrial waste recycling and treatment**

**(Currently paper manufacturers only)**

## *Demand*

Demand in the solid waste sector falls into two categories: urgent demand and medium- and long-term demand. Quantifying demand at this stage is difficult because private individuals are not actually involved in the area (except for the sale and maintenance of transportation equipment). Nonetheless, quantification is possible using the PRONAGDES criteria explained below.

▶ Household wastes

- evaluating by region (23 regions) the quantities of wastes, the source, and the management methods used today
- encouraging private sector investment in this area
- constructing 23 controlled dumping centers
- constructing 5 dumping centers in tourist areas (Hammamet, Sousse, Monastir-Dkhila, Jerba, and Tabarka)
- constructing 3 compost formation units using sludge from treatment stations (Tunis North, Béja and Sousse)
- introducing sorting techniques based on recycling

▶ Septic wastes

- providing hospital incinerator equipment (estimated at a minimum of 30 incinerators in the very short term)
- providing equipment of individual or collective clinic incinerators (including controlled transportation of septic wastes)

▶ Industrial wastes

- constructing a pilot treatment dump for hazardous wastes in greater Tunis
- constructing two pilot dumps, one in Sousse and one in Sfax
- identifying all possibilities for recycling industrial wastes with incentives to individuals aimed at promoting collection and recycling

The volume of industrial wastes has been estimated at 317,200 tons per year distributed mainly as follows:

- 27.8% from steel plants and the first processing phase of the steel
- 5.5% from manufacture of clothing
- 5.3% from the manufacture of sanitary ceramic articles
- 4% from leather and hides
- 3.4% from the manufacture of cast iron and steel products
- 3.1% from the manufacture of metallic structures
- 3% from the dairy industry
- 2.8% from the manufacture of paper and paper pulp
- 2.2% from production and distribution of electricity

Geographic distribution of waste production by region highlights the concentration of wastes in the northeast region encompassing the cities of Tunis, Ben Arous, Bizerte, and

Menzel Bourguiba. Two other governorships producing large volumes of waste are Sfax and Sousse.

It should be noted that fertilizer industry wastes (phospho-gypsum), located only in the Gabès, Sfax, and Gafsa regions, have not been considered in the evaluation shown below.

Distribution of waste production, evaluated by type of associated treatment (based on early research designed to maximize treatment solutions to be adopted), is shown below.

Category	Production (tons per year)
Thermo-destruction treatment	319,000
Managed dumping	226,800
Stabilization/solidification	23,300
Physical chemical treatment	21,300
Recycling	9,500
Managed industrial dumping	6,400
Connection to sewers	1,200
Biological treatment	700

PRONAGDES, however, represents only the "downstream" component for solid waste management. Demand in the "upstream" component is specifically concerned with:

- ▶ acquiring collection material
- ▶ acquiring containers and garbage cans
- ▶ maintaining and keeping up material (existing and future)
- ▶ training personnel
- ▶ consciousness raising

The Municipal Development Project, financed by the national budget and a World Bank loan, has defined a first phase which includes all municipal infrastructure, even the infrastructure for solid waste pick-up and removal. The total cost of this phase is 130 million dinars (over the next six years).

It should be noted that the Plan communal d'investissement (PIC) [Communal Investment Plan] for the VIIIth Plan has been estimated at 425 million dinars (1992-1996).

The AG.005 USAID project includes a large component for institutional support (\$3.5 million out of \$50 million), part of which will be earmarked for environmental protection.

Industrial growth projections for the VIIIth Social and Economic Development Plan are listed below:

- ▶ 10.8% per year for the textile and leather sector
- ▶ 9.2% per year for the mechanical and electrical industries
- ▶ 8.7% per year for manufacturing
- ▶ 7.5% per year for the chemical industries
- ▶ 7.1% per year for the building material, pottery and glass industries
- ▶ 5.6% per year for the agro-food industry

These projections and the expected development of production of hydrocarbons and ore for energy detailed in the tables below assure that total waste production will rise.

For some activities, environmental legislation and regulations in force in Tunisia and the European Economic Community will have a strong impact on the development of industrial waste production. The impact may not be noticeable during the remaining years of the VIIIth Plan but may become so during the years 1997-2000 and beyond.

**Production of Energy and Hydrocarbons during VIIIth Plan**  
(in millions of tons)

Year	1991	1992	1993	1994	1995	1996	VIIIth Plan
<b>Production</b>	5.16	5.06	4.84	4.96	4.35	4.2	23.99

**Production of Energy and Hydrocarbons**  
**during the VIIIth Plan (by deposit)**

Deposit	Production (millions of tons)
Ei Borma	10.48
Ashtart	5.91
Other	1.74
Rahmora	1.60
Sidi-el-Kilani	1.10
Gremda	1.02
Ez-Zaoula	0.76
Tazerka	0.50
Zinaïa	0.48
<b>Total</b>	<b>23.59</b>

**Production of Ore  
(millions of tons)**

<b>Ore</b>	<b>VIIIth Production Plan</b>	<b>Expected Growth in relation to VIIIth Plan</b>
Lead	32	+ 128
Zinc	164	+ 134
Spar	236	- 4.5
Iron	1,500	+ 0.7
Salt	2,250	+ 0.4

The Tunisian government's commitment to developing a cohesive policy for protecting the environment and improving the quality of life, implemented as transparently as possible, points to the emergence of exciting opportunities for specialists in recycling and industrial and hazardous waste treatment. The wastes in question come from:

- ▶ hospitals (with more than 15,000 beds in 1991)
- ▶ clinics, dispensaries, and health centers
- ▶ slaughterhouses (for which 1992 estimated numbers appear in the table below)

	<b>Legal Slaughtering</b>	<b>Illegal Slaughtering</b>	<b>Total</b>
Quantity of meat	40,000	32,000	72,000
Ordinary waste	15,000	12,000	27,000
Contaminated waste	400	360	760
Confiscated waste	120	120	240
<b>Total</b>	<b>55,520</b>	<b>44,480</b>	<b>100,000</b>

## **Measures to Combat Desertification**

The reforestation strategy used to combat desertification and to operate the soil preservation campaign includes these measures:

- ▶ preserving water and soil
- ▶ managing sand deposits
- ▶ reforestation
- ▶ improving pasture lands

Investments in this sector's projects averaged 93 million dinars for the years 1990-1992, including dune fixation.

Investments planned for the sector as part of the VIIIth Plan total 259.3 million dinars. The main funding sources for the investments are cooperation with Germany, the FAO, the World Bank, and the EEC.

Companies involved in combatting desertification fall into two categories: Tunisian companies for technical engineering projects, civil engineering work, and reforestation; and foreign companies for engineering studies and supply of equipment. The coming years will be marked by a continuation of current trends.

For foreign companies, opportunities exist for sale and supply of services and technical equipment such as:

- ▶ engineering studies
- ▶ equipment
- ▶ measuring instruments
- ▶ laboratory instruments
- ▶ remote sensing

The Government's private sector promotion policy indicates that it is opening the desertification control sector to the private market through contracts for projects and supply of services.

### *Products and Services*

1) Ground water preservation. Treatment of 3 million hectares that are threatened by erosion involves these alternative methods:

- ▶ maintaining, protecting, and consolidating CES development projects already carried out and covering an estimated 1 million hectares
- ▶ integrated development of the catchment areas on 600,000 hectares designed to prevent dams from silting up
- ▶ treating 400,000 hectares of agricultural lands with methods that do not harm the environment

- ▶ controlling runoff by constructing 1,000 hillside lakes, hard water irrigation, and waterways management designed to replenish the water table

2) Sand deposit control.

- ▶ constructing 400 km of *tabias*
- ▶ improving 8,000 km of *tabias*
- ▶ protecting 24,000 hectares of dunes of which 6,000 hectares are on the coast
- ▶ rehabilitating and constructing 220,000 km of wind breakers

3) Reforestation. The reforestation program will focus on 320,000 hectares of commercial forests and 20,000 hectares of plantings along highways.

4) Pasture land improvement

- ▶ planting 600,000 hectares of woody and other fodder shrubs
- ▶ developing 2.2 million hectares of pasture lands through reseeded, protection, scarifying, and fertilization
- ▶ reconstituting 107,000 hectares of esparto cover

Funding sources for this type of project (loans and grants) permit open access to foreign companies for equipment supply.

## Evaluation of Opportunities in Desertification Control Measures

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	B	A	A	A
Opportunities for foreign companies	A	D	B	C	B
Opportunities for private Tunisian companies	A	A	B	B	A
Joint venture opportunities	B	C	B	B	B
Long-term markets	A	A	A	A	B
Expected level of competition	A	B	B	C	C
A: Excellent      C: Fair B: Good          D: Poor					

### *Potential Clients*

- ▶ Ministry of Agriculture with its CRDA (Commissariats régionaux de développement agricoles) [Regional Agriculture Development Commissioners]
- ▶ Ministry of the Environment and Land Use Planning
- ▶ National Environmental Protection Agency
- ▶ Northwest Office for Forest and Pasture Land Development
- ▶ Office for Development of the South (ODS) [Office de développement du sud]
- ▶ Ministry of Plan and Regional Development
- ▶ General Commission for Regional Development
- ▶ advisors to the governorships
- ▶ Ministry for National Defense

### *Demand*

Demand in the sector engaged in combatting desertification and soil deterioration falls into two categories: urgent, and medium- and long-term demand.

The VIIIth Plan quantified urgent demand, estimating intervention in the sector at 455.6 million dinars, of which 196.3 were earmarked for CES projects to mobilize water resources, construct hillside lakes, and manage waterways designed to replenish the water table.

For medium- and long-term demand, the studies identified the need to control the main wind corridors (defined as being in the central and southern parts of the country). Program operations supplement one another: dune protection, *tabia* improvement, reconstitution of the esparto cover, reforestation and development, and creation of wind breakers.

This type of project affects the entire area threatened by the desert. The best results may be expected from regional projects that could include more than a single country of the Maghreb. Projects designed to combat desertification in the coming years that have been identified for the central and southern regions are listed on the table below:

**Projects to Control Sand Deposits  
in Central and Southern Tunisia  
(in millions of dinars)**

<i>Tabia</i> creation (km)	2,270
<i>Tabia</i> improvement (km)	4,310
Biological sand fixation (ha)	7,460
Plantings along highways (km)	1,895
Wind breakers and shelters (ha)	6,075
Fixation of wadi banks (ha)	1,890
Planting shrubs for fodder (ha)	16,400
Planting of cactus (ha)	8,000
Reforestation (ha)	13,400
Protection for plantings (ha)	66,740
Improvement of rangeland (ha)	106,000

**Estimated Investments Needed for  
Desertification Control Program  
(in millions of dinars by governorship)**

Sfax	11,600
Kairouan	19,600
Caesarean	15,550
Sidi Bouzid	6,000
Gafsa	3,850
Tozuer	5,150
Kebili	8,000
Medenine	6,000
Tatadaine	2,700
<b>Total</b>	<b>84,300</b>

**Drinking  
Water**

The need for drinking water has continued to grow unabated in urban and rural areas during the period of the VIIIth Investment Plan. Volume produced is increasing at the rate of 1.3 percent per year and will reach 301 million cubic meters by 1996. The percentage of surface water produced is greater (54 percent) than that of groundwater. Volume consumed will increase during the same

period at a rate of 1.4 percent per year, starting in 1991, reaching 211.2 million cubic meters by 1996. Measures to be taken in this area include those listed below:

- ▶ large projects and master plans designed to supply drinking water to various urban and rural centers and to tourist areas
  - desalination plants
- ▶ operating projects covering:
  - network extension
  - acquisition and renewal of rolling stock, material for construction sites and measurements, etc., purchases of meters
  - infrastructure for private buildings
- ▶ presidential program to supply drinking water to remote areas and working class neighborhoods

Investments by the principal operator during the VIIIth Plan total 235.7 million Tunisian dinars. The main funding sources for the investments were as follows:

- ▶ foreign financing
- ▶ Saudi Development Fund
- ▶ Kuwaiti Development Bank
- ▶ IBRD
- ▶ African Development Bank
- ▶ third party investment
- ▶ AFI, AFH, API and governorship councils
- ▶ national budget of Tunisia
- ▶ national resources

Companies operating in the drinking water sector include Tunisian companies for carrying through civil engineering studies, acquiring material, and supplying equipment; and foreign companies for carrying out the same operations as those mentioned above, except for civil engineering.

### *Potential Clients*

**SONEDE (Société nationale de l'exploitation de distribution de l'eau) [National Corporation for Water Use and Distribution]:** for planning water supply, engineering studies, and construction of catchment, piping, and water treatment as well as technical and financial management of networks

Address: 23, rue Jawaher Lal Nehru Montfleury, Tunis

Fax: 390 561

Tel: 493 700

Various entities responsible for monitoring projects for supplying rural areas with drinking water, including:

**Governorship councils (Ministry of the Interior)**

**General Commission for Regional Development**

Address: Rue Rauyaume Arabie Séoudite

Fax: 894 811

Tel: 282 295

**CRDA in the Ministry of Agriculture, Office of Forest and Pasture Land Development in the Northwest.**

Address: Route de Tunis 9000 Béja

Fax: 08 51 718

Tel: 08 51 500

**Ministry of Public Health:** for health and hygiene consciousness raising in the use of drinking water in rural areas

Address: Bab Sâadoun Tunis

Fax: 567 100

Tel: ---

Tunisian National Tourism Office: for engineering studies and connection of hotels to the SONEDE network

Address: 1, Avenue Mohamed V

Fax: 350 977

Tel: 341 077

Associations of Collective Interest (AIC) [Associations d'intérêt collectif]: for NGOs responsible for managing water points and mini-networks in rural environments (over 1,000 of them exist)

### Evaluation of Opportunities in Drinking Water

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	A	A	A	B
Opportunities for foreign companies	A	C	A	B	B
Opportunities for private Tunisian companies	A	A	A	A	B
Joint venture opportunities	B	C	A	C	B
Long-term markets	A	C	A	A	B
Expected level of competition	A	A	A	A	B

A: Excellent      C: Fair  
B: Good          D: Poor

### Products and Services

- ▶ Corporate public works services, drilling and industrial construction
- ▶ water treatment
- ▶ material and equipment supply
- ▶ personnel training
- ▶ electrification of pumping and desalination stations
- ▶ engineering studies
- ▶ water quality monitoring

## *Demand*

Demand in the drinking water supply sector falls into two categories: demand in urban or semirural environments, and demand in rural environments

In rural environments, demand is limited to prospecting, construction, and medium-sized pumping equipment used to supply rural populations with water. Its regional structures make the Ministry of Agriculture the major player in this area. This type of opportunity is attractive only when use of renewable energy has been introduced through wind-powered engines and photovoltaic panels.

The supply of electricity and drinking water will improve living conditions in rural areas. The supply will be a great help in relieving pressure on the ground cover which is frequently overused to meet the need for wood. Supplying water and electricity could encourage rural families to plant more trees and to reduce the amount of ground cover cut.

In urban environments demand is traditional:

- ▶ network maintenance
- ▶ network extension
- ▶ storage facility construction
- ▶ equipment for stations
- ▶ constant quality control
- ▶ water treatment

Given the scarcity of high-quality water in certain regions of the country, the demand for desalination is growing. The VIIIth Plan provides 235 million dinars for drinking water. Since SONEDE is the main player in this area, demand in the sector will closely parallel the needs of this public corporation which uses specific equipment for its projects and network development.

- ▶ piping (about 1,100 km per year, mostly polyethylene)
- ▶ foundry products (special parts for air conditioning pipes, 50,000 units a year, inspection chambers, clamps and faucet valves for connections (240,000 units per year))
- ▶ fittings (3,000 per year)
- ▶ meters (90,000 per year)
- ▶ pumping generators
- ▶ chemicals (particularly liquid chlorine and aluminum sulphate)

## *Specialized Services*

- ▶ companies specialized in laying networks
- ▶ civil engineering companies
- ▶ drilling companies

SONEDE's main projects are indicated below.

- ▶ Supplying drinking water and new hydraulic infrastructures to 634 rural localities. The World Bank is helping to finance this project in foreign currency with \$50 million.
- ▶ Supplying drinking water to Sfax  
Total cost: 50 million dinars  
Source: Saudi Development Fund
- ▶ Supplying drinking water to Cap Bon  
Total cost: 22 million dinars  
Source: African Development Bank
- ▶ Supplying drinking water to greater Tunis  
Total cost: 15 million dinars  
Source: FKD
- ▶ Improving water quality in greater Gabès  
Total cost: 22.5 million dinars  
Source: funds from Belgium and Holland
- ▶ Recalibrating the Kairoun water pipeline  
Total cost: 22.2 million dinars  
Source: Tunisian government
- ▶ Supplying drinking water to the southern region of Tunisia

Given the increased need for water, total investments required from SONEDE between 1992 and 1996 amount to 35 million dinars, 35 million of which were invested in 1992 and 44 million planned for 1993. The table on the next page shows SONEDE investment projects for 1994, 1995, and 1996.

**SONEDE Investment Projections for 1994, 1995, and 1996**  
(in millions of Tunisian dinars)

<b>Projects</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>
<b>I. Renewal - major maintenance: network development</b>	<b>17.835</b>	<b>20.422</b>	<b>22.919</b>
Acquisitions and renewal	3.349	4.559	4.050
Extensions and recalibrating meter networks	12.229	13.453	16.292
<b>II. Internationally funded projects AEP</b>	<b>5.576</b>	<b>5.313</b>	<b>22.937</b>
Sfax and Sahei with waters from north	3.620	3.750	1.946
AEP greater Tunis (first phase)	1.756	1.563	991
<b>III. Government funded projects</b>	<b>15.916</b>	<b>9.251</b>	<b>6.221</b>
Gabès desalination station	10.761	3.454	401
Tabarka tourist project	169	0	449
AEP rural centers (7th loan)	4.986	5.798	5.371
<b>IV. Third party funded projects</b>	<b>1.921</b>	<b>4.113</b>	<b>5.197</b>
South Tunisia	543	2.413	4.050
Other AFH API projects	1.378	1.700	1.147
<b>V. SONEDE funded projects</b>	<b>6.850</b>	<b>6.557</b>	<b>5.989</b>
Centers to be upgraded	2.888	2.293	2.421
Kairounnais pipeline recalibrating	479	51	0
Infrastructure	616	188	33
Computer equipment	326	22	0
Greater Tunis (2nd phase)	886	1.613	2.065
Cap Bob-Grombalia	236	604	295
South pipeline for the city of Tunis	650	800	200
South bank of Bizerte	593	713	720
Water savings	180	275	255
<b>VI. Presidential program</b>	<b>5.318</b>	<b>4.000</b>	<b>2.386</b>
Rural centers	4.193	3.625	2.386
Working class neighborhoods	1.125	375	0
<b>Year Total</b>	<b>53.415</b>	<b>49.655</b>	<b>45.648</b>

## **Industrial Pollution Control**

The concentration of large industrial projects in some regions of Tunisia has negatively affected the urban and natural environment. In cities like Gabès and Sfax, pollution problems sparked a special program designed to combat industrial pollution.

Tunisia has implemented a series of remedial measures in the polluted areas (Gabès, Sfax, Ben Arous, Sousse, Mehdiya, Hasserrine).

It has also developed a mechanism to ensure accountability of those responsible for the problem so that they assume part of the pollution control costs. Tunisia's strategy for pollution control includes the following measures:

- ▶ remedial measures
- ▶ implementation of a prevention system based on previous impact studies
- ▶ incentives to reduce pollution levels
- ▶ taxation of polluters
- ▶ pollution control and prosecution of offenders

Investments in this sector are now being made, especially in pre-treatment of industrial water. A total of a little over one million dinars has been invested in this area since ANPE launched the first pollution control program on June 14, 1990. The major funding sources for the investments in this sector are:

- ▶ grants from special funds for environmental conservation
- ▶ grants from countries supporting Tunisia in its environmental protection programs (Germany, Sweden, Holland)
- ▶ subsidized loans
- ▶ traditional loans
- ▶ the national budget
- ▶ industrial company budgets (public and private).

A special fund was established in 1993 to control industrial pollution.

Since this is a new area, and since the Tunisian government is committed to carrying through its anti-pollution program already launched in the Gabès and Sfax regions, attractive, large-scale opportunities for intervention are expected.

Expansion in this area seems limited to private companies, since the Tunisian government does not intend to establish any new agencies for this type of intervention.

The two engineering companies established for the Taparoura project in Sfax and the South Lake project in Tunis will limit their involvement to piloting the projects whose engineering, carry-through, and monitoring will be subcontracted to private concerns.

### *Products and Services*

For foreign and Tunisian companies, opportunities exist in these areas:

- ▶ impact studies
- ▶ pre-treatment studies
- ▶ pollution control studies
- ▶ feasibility studies of procedures to reduce polluting effluents
- ▶ measurement and monitoring equipment
- ▶ interventions designed to reduce pollution created by manufacturing (or production) procedures
- ▶ recycling equipment and/or reutilization equipment for industrial wastes (liquid, gas, solid)

### Evaluation of Opportunities in Industrial Pollution Control

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected development	A	A	A	A	A
Opportunities for foreign companies	A	A	A	A	A
Opportunities for private Tunisian companies	B	C	D	C	B
Joint venture					

Some donors use their own country's companies for sale and supply of services and equipment in the form of:

- ▶ engineering studies
- ▶ feasibility studies to modify production processes
- ▶ studies on recycling opportunities and opportunities to reutilize industrial components
- ▶ measuring instruments
- ▶ pre-treatment and filtering equipment
- ▶ installation of new manufacturing processes
- ▶ industrial expertise

### *Potential Clients*

The main players in this sector are listed below:

- ▶ Ministry of the Environment and Land Use Planning
- ▶ National Environmental Protection Agency (ANPE)
- ▶ National Sanitation Office (ONAS)
- ▶ AFI
- ▶ public and private manufacturers
- ▶ donors interested in environmental problems
- ▶ NGOs

Manufacturers (public and private companies), the ANPE, and the NGOs are among the most attractive potential clients for businesses seeking opportunities in pollution control.

### *Demand*

Demand in this sector falls into two categories: urgent, and medium- and long-term. PANE quantified urgent demand, estimating the cost of pollution control measures at 156 million dinars. Of this figure, 4.5 million dinars will be earmarked to control hydrocarbon pollution and more specifically, to equip ports with material to be used for interception.

**Project Designation and Scope of Operations**  
(in millions of US dollars)

	<b>Total</b>
<b>Gabès chemical industries</b>	
Stopping SO <sub>2</sub> emissions, two treatment units	16.50
Phosphogypsum discharge with water recycling	38.50
Stopping SO <sub>2</sub> emissions, four treatment units	33.00
Fluorine recovery (study)	0.12
<b>Total Project</b>	<b>88.12</b>
<b>Gafsa Phosphate Company</b>	
Washing plants and ventilation equipment replacement	4.40
Stopping SO <sub>2</sub> emissions (ICG-SIAPE IV)	6.00
Slime/sludge dehydration (study)	0.25
<b>Total project</b>	<b>10.65</b>
<b>Waste area from Lake Tunis (30 units)</b>	
Diagnostic study	0.55
Inventory and analyses	0.13
Assistance for financing equipment purchases	6.00
<b>Total project</b>	<b>6.68</b>
<b>Tanneries</b>	
Pre-treatment facilities	6.00
Changes in processes used (study)	0.14
<b>Total project</b>	<b>6.14</b>
<b>Agro-food industries</b>	
Environmental impact studies	0.35
Anti-pollution equipment (supplies)	15.00
<b>Total project</b>	<b>15.35</b>
<b>Other industries and industrial areas</b>	
STIR (oil refinery) Bizerte	0.27
El Fouladh (steelworks) Menzel Bourguiba	0.25
SIAPE (phosphates) Sfax	2.80
Other industries in Sfax (studies)	0.30
Anti-pollution equipment in Sfax (supplies)	10.00
Industrial area of greater Sfax (supplies)	5.00
SOTUPALFA (paper) Caesarean	2.50
AL-MOIZ CHEMICALS (furfural) Mahdia	4.00
<b>Total industries</b>	<b>152.06</b>
<b>Hydrocarbon control</b>	
General study for program	0.13
Study on recovery of waste oils	0.09
Technical studies (5 ports)	0.33
Interception equipment (5 ports)	4.00
<b>Total Hydrocarbons</b>	<b>4.55</b>
<b>Industrial Pollution</b>	<b>156.61</b>

For the long term, raising the Tunisian public's level of awareness is the best guarantee of continued progress for the activities already launched.

In the future, impact studies and monitoring activities will play an important role, whether carried out by the manufacturers themselves (self-monitoring) or by the ANPE, the only entity qualified to do so.

The Tunisian government is not currently intervening in the major problem areas, but the industrial fabric of the country requires intervention for national and international environmental protection.

Adequate financing for the newly created anti-pollution fund will affect the success of Tunisia's industrial pollution control program. Countries involved in financing the fund will benefit their own companies working in the market created by pollution control measures.

It is important to recall that Tunisian law in pollution control is effective and well developed. Its enforcement depends on the government's political will to protect the environment and to combat all pollution sources.

The first pollution control program launched by ANPE has produced very satisfactory results. For it to develop further, it requires only that ANPE's resources be somewhat strengthened through technical assistance and supply of monitoring equipment.

## **Water Resources**

Despite broad access to the Mediterranean, Tunisia's arid climate and geographic position at the edge of the Sahara mean that water is a scarce resource, poorly distributed in both space and time. Planning and water resource management are vital to ensure a reliable water supply.

The country's total identified water resource potential today does not exceed 4.3 billion cubic meters a year out of the 33 billion cubic meters of annual precipitation. A total of 1.7 billion cubic meters is needed to supply the water table, which is the underground renewable water resource; 2.6 billion cubic meters per year is the total water runoff. This runoff should be utilized by means of dams, hillside banking, catchment, and water distribution works.

The water resource sector includes construction needed to collect all surface water resources, and test drilling needed for use of underground water resources.

Investments in this sector in 1990-1992 amounted to 20 million dinars, exclusive of large dams.

The total cost of the water resource development strategy during the 1990s will be 1,939 million Tunisian dinars, of which 87 percent will be used to build hydraulic works

permitting mobilization of all the country's known resources. The main investment funding sources have been the national Tunisian budget and loans from the World Bank.

Companies working in the water resource sector today fall into two categories: Tunisian companies for some civil engineering studies and supply of piping, and foreign companies for civil engineering studies and hydraulic supplies.

For foreign companies, opportunities exist in sales and supply of equipment services such as:

- ▶ engineering studies
- ▶ monitoring and follow-up equipment for exploratory drilling
- ▶ pumps
- ▶ electric motors
- ▶ climatology stations and rain simulators
- ▶ laboratory equipment
- ▶ monitoring equipment for dam banking silting-up
- ▶ nuclear gauges and sampling equipment to measure wadi sedimentation
- ▶ preparation of satellite images

The fact that the government is focusing on encouraging the private sector points to the development of an important market for supply and installation of equipment for water resource management.

### *Products and Services*

To develop underground water resources:

- ▶ conducting feasibility and technical studies of the master plan
- ▶ prospecting drilling
- ▶ drilling
- ▶ acquiring monitoring and follow-up equipment for prospecting
- ▶ training personnel
- ▶ acquiring equipment to induce replenishment and artificial supply of the water tables
- ▶ acquiring water quality control material

To develop surface water resources:

- ▶ conducting feasibility and technical studies of the master plan
- ▶ constructing large dams
- ▶ constructing hillside dams
- ▶ constructing hillside lakes
- ▶ constructing water distribution works
- ▶ providing equipment for liquid level meter stations on the wadis
- ▶ completing cable equipment

- ▶ providing surface water quality monitoring and follow-up systems:
  - salinity measurement and recording equipment
  - laboratory equipment
  - nuclear gauges and sampling devices for measuring sedimentation
  - monitoring equipment for dam banking silting-up
- ▶ developing high water indication system
  - relays and transceivers
  - telemetry systems
- ▶ developing databanks
  - computer hardware acquisition
  - software acquisition and development

### Evaluation of Opportunities in Sanitation

	Engineering Studies	Construction Materials	Materials Supply	Maintenance	Personnel Training
Expected Development	A	A	A	A	B
Opportunities for foreign companies	A	C	A	C	B
Opportunities for private Tunisian companies	B	A	C	C	B
Joint venture opportunities	B	D	B	C	B
Long-term markets	B	A	B	B	B
Expected level of competition	B	B	B	C	C
A: Excellent      C: Fair B: Good          D: Poor					

### *Potential Clients*

- ▶ Ministry of Agriculture
- ▶ Ministry of Equipment and Housing
- ▶ Ministry of the Environment and Land Use Planning
- ▶ National Methodology Institute
- ▶ National Sanitation Office
- ▶ SONEDE

- ▶ STEG
- ▶ private companies engaged in prospective drilling

### *Demand*

Demand in this sector over the next 10 years falls into two categories. The first is the construction needed for catchment of all currently identified water resources:

- ▶ 21 large dams (one of which is being completed)
- ▶ 203 hillside dams
- ▶ 1,000 hillside lakes in the northern and west-central part of the country
- ▶ 2,000 water distribution works in the central and southern parts of the country
- ▶ 2,000 discharge sites for areas where the water table is over utilized
- ▶ water and soil conservation works at all catchment areas

The second category is the drilling required in order to use all currently identified underground water resources:

- ▶ 610 drilling sites
- ▶ 500 replacement drilling sites

Quantification of demand in this sector will cost 1,939 million Tunisian dinars distributed as indicated in the table on the following page.

**Cost of Activities Designed to Develop Water Resources**  
(in millions of dinars)

<b>I. Surface Water Resources</b>		
I.1	Mobilization works	1,529
	▶ 21 large dams	923
	▶ 203 hillside dams	400
	▶ 1,000 hillside lakes	88
	▶ water distribution works	188
I.2.	Measurement networks	10
	▶ Pluviometric and pluviographic network (150 + 300)	2.5
	▶ Hydrometric network	
	- 400 liquid level meter stations on wadis	2.8
	- 100 complete cable equipment	2.5
	- 300 measuring stations (civil engineering)	0.5
	▶ Special equipment for experimental tanks	
	- climatologic stations, rain simulators	0.6
	▶ Logistical support	1.1
I.3	Quality control and follow-up systems	4
	▶ salinity measuring and recording equipment	0.4
	▶ equipment for 20 laboratories	1.2
	▶ nuclear gauges and sampling devices for measuring wadi sedimentation	0.7
	▶ equipment for controlling dam banking silting up	0.6
	▶ logistical support	1.1
I.4	High water indication network	5
	▶ relays and transceivers	1.5
	▶ telemetry systems	2.0
	▶ logistical support	1.5
I.A	Databank	
	▶ computer hardware acquisition	6
	▶ software acquisition and development	3.5
	▶ satellite images and processing	1.0
Cost of strategy over 10 years:		
	▶ mobilization works	1,529
	▶ measurement, catchment, analysis, protection, and forecasting networks	25
<b>Subtotal of Costs</b>		<b>1,534</b>

<b>II. Underground Water Resources</b>		
II.1	Mobilization of all underground water resources:	
	II.1.1 610 new drilling sites	60
	II.1.2 500 replacement drilling sites	45
II.2	Acquisition of monitoring and follow-up equipment for prospecting works	0.495
II.3	Perfecting technical equipment and logistical resources	4.27
II.4	Prospecting and identification of secondary aquifers	2.0
	2,500 electric drilling sites	.75
	250 seismic drilling sites	.75
	Map drawing	.25
II.5	Setting up 1,150 exploratory drilling sites	169,623
II.6	Setting up 2,300 piezometers	69
II.7	Setting up test pumping and mathematical models for water table utilization	6.25
II.8	Induced replenishment and artificial supplying of the water table (installation and equipment for 100 sites)	5.0
II.9	Reutilization of wastewaters and water quality control network	18
II.10	Reutilization of drainage waters	
	Monitoring network	2.4
II.11	Desalination of brackish waters	
	Inventory of salty water tables	800,000
	Projection mode	2
	Monitoring network	3.6
II.12	Creation of a corps of public hydraulic inspectors	1,725
<b>Subtotal of Costs</b>		<b>385,063</b>

## *Entities Interviewed*

- A. Government (5)
  - 1. Ministere de l'Environnement et de l'Amenagement du Territoire
  - 2. Agence Nationale de Protection de l'Environnement (ANPE)
  - 3. Ministere de l'Equipement et de l'Habitat:  
Societe Etude et de Promotion du Lac Sud de Tunis
  - 4. Ministere de l'Economie Nationale: Agence de Maitrise de l'Energie (AME)
  - 5. Ministere de l'Agriculture: Societe Nationale d'Exploitation et de Distribution des Eaux (SONEDE)
  
- B. Parastatals and Chambers (1)
  - Chambre Syndicale des exploitants des carrieres
  
- C. Discharges
  - 1. Industries (5)
    - a. CIOK--Tajerouine (cement)
    - b. Compagnie des phosphates de Gafsa (phosphate)
    - c. Tanneries BEN ARAB-SFAX
    - d. Les grandes Carrieres du Nord (stone quarry)
    - e. Maghreb Carrelage (ceramic quarry)
  
  - 2. Medical (1)
    - Centre hopitalo--Universitaire Sahloul-Sousse
  
  - 3. Chemical Storage/Transport (2)
    - a. C.P.G. Gafsa
    - b. SNCFT
  
  - 4. Commercial (1)
    - Magasin General-Hammam Lif
  
  - 5. Construction (1)
    - Societe Nationale Immobiliere de Tunisie
  
  - 6. Municipal Services (1)
    - Agence Municipale de Traitement et de valorisation des Dechets

- 7. Environmental Business (9)
  - a. Construction (n/a)
    - Equipment Manufactureres (1)
    - Jugurtha Manutention
  - b. Equipment Supply and Operations and Maintenance (3)
    - 1. STA Holding
    - 2. l'Installateur
    - 3. Groupe Loukil
  - c. Testing Laboratory (3)
    - 1. Laboratoire de l'Environnement--ENIS--SFAX
    - 2. Institut Pasteur (Marin Pollution)
    - 3. Laboratoire de la Municipalite de Tunis (Air Pollution)
  - d. Treatment (1)
    - Office Nationale d'Assainissement--Direction Regionale de Tunis (ONAS)
  - e. Recycling (1)
    - A.M.T.V.D.
  - f. Training/Education (2)
    - 1. Ecole Nationale d'Ingenieurs de Tunis
    - 2. Ecole Nationale d'Ingenieurs de Sfax
  - g. Financial/Banker (1)
    - Caisse de Pret et de soutien aux Collectivites Publiques Locales
  - h. Others (2)
    - 1. Association des Anciens de l'Ecole Nationale d'Ingenieurs de Tunis
    - 2. Association Tunisienne de Protection de la Nature et de l'Environnement