

FINANCIAL, ORGANIZATIONAL AND TECHNOLOGY STRATEGIES FOR
WASTEWATER TREATMENT PROJECTS IN SMALL AND MEDIUM SIZE
COASTAL MUNICIPALITIES IN GREECE

by

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THESIS ABSTRACT

Financial, Organizational and Technology Strategies for Wastewater Treatment Projects in Small and Medium Size Coastal Municipalities in Greece

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Thesis Supervisor: Fred Moavenzadeh, Director, Center for Construction Research and Education

The objectives of this thesis are, first, to propose an alternative project financing and organizational structure for wastewater treatment projects (WTP) in Greece and, second, to evaluate the potential benefits of chemically-enhanced wastewater treatment technology (WTT) for coastal municipalities in Greece. The thesis has been supported by the Industrial Development Bank of Greece (ETBA), which will initially implement the proposed structure. The new structure takes advantage of the legislative opportunities offered to the Bank as a State Bank, and does not require political manipulations and changes of the existing laws.

The methodology followed to fulfill the first objective has three stages. First, the policy and financial principles which have led the whole study are set. Second, for lack of such previous research, a thorough study of the current financing and organizational status of WTP is completed for Greece. A general framework for organizing and financing WTP is presented based in part on information derived from the analysis of organizational and financing methodologies followed in Great Britain, Germany and France. Project finance, user fees, bond financing, and privatization approaches are analyzed and their potential application for WTP in Greece is evaluated. Additionally, the changing responsibilities and opportunities which a State Development Bank has to face under this framework are determined. The study has demonstrated that development programs supported by the European Community (EC) are the only significant long-term financial resource for WTP in Greece. The problem is that the existing highly bureaucratic management model does not allow for their efficient use. A new structure and the strategic role of ETBA in it, are then, presented. If this structure is adopted, responsibility for the realization of projects will pass partially through the Bank to the private sector, and more EC funds will be efficiently invested in Greece.

To fulfill the second objective, the conventional WTT currently implemented in Greece is studied and compared to the emerging chemically-enhanced WTT. The preconditions which need to be satisfied by an efficient technology strategy for coastal areas are defined and their potential achievement by chemically enhanced technology is evaluated. The

study has demonstrated that significant performance and cost advantages can be gained by the implementation of a lime/seawater process. However, more cost data are required to quantitatively prove its cost benefits. The construction and operation of an experimental plant in Greece is proposed.

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Chapter 1

INTRODUCTION

In section 1.1, the objectives and the scope of the thesis are presented. Section 1.1.1 contains the objectives of the Industrial Development Bank of Greece, which supported and promoted this thesis, are presented. Because the action of the thesis is mainly placed in the small and distant country of Greece, an overview of the current economic constraints in Greece, whose influence is diffused throughout the whole thesis, is presented in section 1.2. Finally, in section 1.3, the outline of the thesis structure is presented, to help the reader follow the research steps.

1.1 Objectives and scope of the thesis

There are two objectives of this thesis. The first, is to propose an alternative project financing and organization structure for the construction of sewerage and wastewater treatment facilities in Greece. The second, is to evaluate the potential benefits of chemically-enhanced wastewater treatment technology for coastal municipalities with high demand variances -as is the case with a great number of Greek municipalities.

These projects have traditionally been under the total control of the "government/ state/ municipality" management model. This model, though it works in other countries, has proved to be inefficient in Greece. The need for a domestic innovation has been publicly

admitted by government officials, municipal officials, and citizens. The problem gets even worse under the constrained current economic environment in Greece. Methodologies and models implemented in other countries are discussed and their potential application in Greece is evaluated.

The technology traditionally implemented in wastewater treatment facilities in Greece is that of "conventional primary treatment", or where higher standards are required, "secondary biological treatment". However, recent research has demonstrated significant performance and cost advantages related to what is referred to as "chemically enhanced wastewater treatment". The case becomes very interesting because this method is claimed to be especially effective for coastal municipalities, with high demand variance, and because lime and seawater which are abundant in Greece, are tested as potential additives.

The Industrial Development Bank of Greece has been one of the public corporations which have been sensitized by the situation. As a consequence, it has started evaluating its potential contribution to the realization of infrastructure and particularly of sewerage and wastewater treatment projects. This thesis constitutes the research and the result of this evaluation. The initial assumption of this study has been that the proposed structure must not require political manipulations and changes of the existing laws.

In the next section the objectives of this research from the point of view of the Industrial Development Bank of Greece are presented.

1.1.1 Objectives of the Industrial Development Bank of Greece

During the last decade, public opinion became very sensitive to the importance of projects

and facilities concerning environmental protection and improvement for public health. Sewerage and wastewater treatment facilities represent a significant part of the environmental projects which have become very popular. In Greece, infrastructure related to environmental protection and public environmental education are still at primitive stages. The contrast is that a clean environment is one of the key factors of a successful tourism policy, which is one of the key financial-sources of the Greek economy.

The Industrial Development Bank of Greece (ETBA) believes, as Dr. A.C.Demacopoulos, Deputy Governor of ETBA, has stated in a recent interview, that " ... infrastructure projects have a pure development character, as they provide the prerequisite environment for economic development activities ... "¹. Among all categories of infrastructure projects, ETBA believes that environmental projects constitute a group which definitely requires a more organized and well-planned policy in Greece. However, environmental projects have the great disadvantage that their product, or contribution, is not quantifiable with traditional measures. On the other hand, they can gain a significant advantage if the public is properly educated on the potential benefits.

ETBA estimates that it has the financial and technical expertise to take a leading role - profitable both for the bank and for society- in the environmental infrastructure industry. It intends to participate as a Technical Advisor and/or Financial Advisor and/or Funding Manager of the owner -government, or municipal corporation- for environmental projects. The initial focus will be on sewerage and wastewater treatment projects for small and medium size coastal municipalities. The reasons for the selection of this specific group of environmental infrastructure projects are the following:

1. ETBA has financial and technical experience in similar projects, which it has

¹ Source: "TYPOS TIS KYRIAKIS", Athens Sunday newspaper, 7.7.91

financed, managed and operated for the Industrial Areas.²

2. The high availability of European Community funds, which until now have been misused.
3. The contribution of such projects to a cleaner sea, which is a great advantage for the marketing both of the projects and of ETBA's role, because:
 - "All" Greek people love the sea and recognize the value of a clean sea for Greece.
 - The citizens of Athens -half the population of Greece- have had the bad experience with Saronicos bay. Fifteen years ago, the Saronicos Bay had beautiful beaches, and was one of the favorite resorts of Athenians. Today, it faces high pollution problems in many areas because of the wastes of Athens and Pireus which, until recently, have been discharged in it without any treatment.
4. The size of the needs, especially for municipalities which serve as summer resorts.
5. The fact that they do not require particularly high technology. Their needs can be served in majority by Greek engineers and technicians.

ETBA's objective from a management point of view is to propose a new organizational, financial, and technical structure for the financing, construction, operation, and maintenance of sewerage and wastewater treatment facilities, which will not require time-consuming legislative changes but instead will benefit from the advantages offered to ETBA by the existing laws. At the same time, ETBA intends to promote cooperation between the public and the private sector, by providing a legal platform which will not invoke legal constraints on the private sector's active participation in all project phases. If the platform proves to be effective, a similar one can be extended for other

² Industrial Areas are sites all around Greece, which are initially owned by the government and which are offered for industrial development under very good economic terms. ETBA has, by law, the responsibility to negotiate the deals and to provide all the required infrastructure.

infrastructure projects.

ETBA's objective from a financial point of view is to create an efficient funding mechanism and a well-functioning investment control mechanism which,

- Will function both cooperatively and independently to the funds available from the Public Development Account and the Deposits and Loans Bank,
- Will ensure an efficient use of the managed funds,
- Will offer an advising support to the exploitation of the financial opportunities offered by E.C. development programs, without limiting their activity to the programs' pre-defined duration, number, and percentage of funding participation to the project cost,
- Attract private funds and exploit the private sector technical and managerial experience

ETBA's proposal from a technical point of view intends to promote a more economic technology strategy at the design phase, and a more efficient operation and maintenance strategy during the operation phase. A point of particular interest is the potential implementation of new and more cost-effective technology, which can provide additional E.C. funding programs aiming to support implementation of new technology.

ETBA's proposal is addressed to

1. The Government, by providing the basis of a development environment where the wastewater and sewerage facilities problem will be confronted without inefficient spending of Government Grants.
2. To the Municipality Authorities, by proposing a new project financing and realization mechanism. This, in the short term may look more expensive as it includes a Bank looking for business profit. However, in the long term, its benefits will be more significant because the project will be finished on time and under

budget, and because the Utility Management company will be organized with private business criteria.

1.2 Overview of the current economic environment in Greece

Greece is the European Community (EC) country-member which, in the face of the European Economic Integration of 1992, suffers from the most severe economic problems. In this section, a review of five major economic reports and their criticisms and recommendations is presented. They will help justify the efforts of an active group of the Greek society aiming to reorganize the existing investment and development structure, and attract foreign investments by improving the business climate of Greece.

In a recent report published by the Economic Chamber of Greece³, it is stated that in order to confront the existing economic constraints, three different groups of immediate measures are proposed/required:

1. Promotion and improvement of infrastructure projects. The government has demonstrated a complete indifference to this area of public responsibility, though it is a prerequisite for the achievement and conservation of a satisfactory investment level
2. Co-ordination and reactivation of the private sector for the reorientation of the public sector. The objectives will be a more decentralized and less bureaucratic structure, a more efficient public expenditures program, and a new status of public/private cooperation
3. Formation of a competitive business environment, concentrating on the

³ Source: "BHMA", Athens Sunday newspaper, 19.5.91

exploitation of the opportunities offered by EC.

The annual report of the Governor of the Bank of Greece is each year's fundamental economic document. The facts that he brings to publicity and the views he sets out constitute the most reliable description of the current economic situation. The key issues he referred to, in his 1991 report are⁴:

1. Development Stagnation, which was the main characteristic of the '80s -or the "Lost Decade" as it is called for this reason- seems to be continuing during the first years of the '90s. According to the report, the GNP in real values, declined by 0.4% in 1990, though it had increased by 4.7% in 1988 and by 3.4% in 1989. The report message for 1991 is not at all optimistic. It states that, "according to the existing indications and the factors of short-term production development, the decline of the rate of economic development, which started by the end of 1989, seems to have continued after the second quarter of 1990 and is expected to continue during 1991". If one considers that the average rate of economic development (the increase of GNP in real values) in EC was 2.9% for 1990 and is expected to be 2.2% for 1991, it becomes clear that Greece runs the risk of remaining on the margin of the European Economic Integration.
2. Budget Deficit The budget deficit is still higher than ever before. The report states that, "The government budget for 1990, which was accepted by the Parliament last May after a six month delay, forecasted a deficit of 1,700 billion drachmas, or 16% of GNP, -excluding amortization funds. According to the Bank's indications, the budget deficit was finally 1,836 billion drachmas or 17.8% of GNP compared to 16.5% in 1989".
3. Drachmas Exchange Rate The report does not agree once more with the demand

⁴ Sources: "Bank of Greece: Annual Report 1990", and "BHMA", Athens Sunday newspaper, 5.5.91

of private investors for a drachmas exchange rate decline as a solution to raise the competitiveness of Greek goods. The acceptance of the demand would further push inflation to high levels, although the primary government objective is the control of inflation.

4. Investments In 1990, the rate of increase of total gross investment in fixed assets was 5.2% compared to 9.8% (in constant values) in 1989. The difference was the result of a decrease in public investments. Private investments continued to increase for the fourth consecutive year, primarily due to high corporate profits. However, the expectations for 1991 are not as optimistic. Private investments are not adequate to move the country out of the recession, primarily due to their low quality, and low productivity character which is the result of infrastructure deficiency.
5. Inflation The most optimistic conclusion of the report is that inflation is expected to decrease. As it is stated, "According to the government, inflation is expected to decrease to 17% in 1991. According to the Bank of Greece, the prospect that the inflation in 1991 will decrease to levels lower than 17% seems highly probable, if strict government monetary policy continues".
6. Bank Deposits and Bonds The high level of budget deficit forces the government to issue high-yield bonds, which are obviously preferred by investors. The result is that most of the available financial resources of the country are used by the government, thereby decreasing the level of bank deposits and raising the cost of capital for new investments.
7. Investment Climate "Economic development is more a climate than numbers and factors", is a common rime of C.Karamanlis, President of Greece. The Governor further enhances this rime when he writes, "... the government policy does not help create the appropriate economic climate, which is a precondition for new productive investments and for the restructuring of the economic infrastructure". First, the high public deficits maintain inflation at restrictively high levels, making

it difficult to cultivate a climate appropriate for economic development. Second, the appropriate climate requires an analogous infrastructure, which in Greece is either non-existent or obsolete. Other problems include the bureaucracy and the low service quality of the public sector, the common government interventions to most economic activities, and the unexpected changes of government policy.

Another important economic document is the annual report of the European Committee commenting on the problems that the EC countries have to face before the final economic integration. In this report the EC point of view on the Greek problem is stated (Table 1.1)⁵:

1. Inflation The inflation rate for Greece is forecasted to be around 18% in 1991. This is more than three times more than the average of the other eleven EC countries, which is about 5% . The problem is that inflation in Greece is five to seven times higher than it is in Germany, Denmark, Belgium, France, Ireland and Holland, which are ready to participate in the monetary integration and which have doubts whether Greece can follow them. The 1992 forecast for inflation is 13%. Although this shows an expected improvement, it remains significantly higher than Portugal, which has the next highest inflation rate in EC -11.6% for 1991 and 9.8% for 1992.
2. Budget Deficit The financing needs of the Greek government budget are equal to 15.3% of GNP, compared to the average 4.6% for the other eleven countries. Greece is the EC member which is required to raise the largest amount of capital in order to maintain the proper functioning of the public sector. The public debt of Greece, although very high, is not the main concern of the European Committee as three other members, Belgium, Italy, and Ireland, have a higher public debt.

⁵ Source: "EPENDYTIS" (INVESTOR), Athens weekly newspaper, 16-17.8.91

EC COUNTRIES: FORECAST OF ECONOMIC INDICATORS FOR 1991

	Inflation	Public sector financing needs	Public debt	National deposit level
	(%)	(%GNP)	(%GNP)	(% GNP)
Belgium	3.2	6.5	128.1	20.8
Denmark	2.4	1.3	62.3	19.0
Germany	3.6	4.6	45.4	23.4
Greece	18.0	15.3	86.0	13.6
Spain	5.9	2.7	44.5	23.0
France	3.1	1.6	37.3	20.1
Ireland	3.0	3.8	97.4	21.7
Italy	6.3	10.1	103.3	19.5
Louxeembourg	3.5	-1.6	4.7	57.4
Holland	2.8	4.8	78.8	24.9
Portugal	11.6	5.5	63.8	27.1
UK	6.5	2.2	44.5	14.6
Average (excl.Greece)	5.0	4.6	60.0	20.3

**TABLE 1.1 : GREEK ECONOMY COMPARED TO EC COUNTRIES
(1991 FORECASTS)**

Source : European Committee

3. Deposits The national deposit level as a percentage of GNP is lower in Greece than it is for any other EC member which is not adequate to finance new investments. Therefore, public expenditures must be decreased and real interest rates must be increased, so that the capital required for the planned economic development activities of the next few years will be raised.
4. Investments One significant factor is the rate of increase of total investment, in real values. For Greece, the European Committee forecasts an increase of 3% for 1991 and 7% for 1992, compared to 0.75% and 3.75% respectively for the average of the other EC countries.

The third important source of economic documents referring to the current status of Greece as it is perceived by foreign political and financial organizations, is the Organization for Economic Cooperation and Development (OECD) annual report⁶. In its 1990 report, OECD seems optimistic about the economic prospects in Greece.

The main causes of the economic crisis in Greece are summarized by OECD, as being:

1. The increase of non-productive public expenditures and of the budget deficit, which raised the financing needs of the public sector to 30% of GNP and quadrupled the foreign debt compared to the late '70s.
2. The decrease of the national deposit level by 10% during the last decade and the consequent crisis in investments, which, after the 1990 increase, reached the 1979 level.

On the short-term, OECD expects a significant improvement in the basic economic constraints, supported by an increasing improvement of the business climate and by social consensus.

⁶ Source: "ELEYTHEROTYPIA", Athens daily newspaper, 15.4.91

1. Budget Deficit The budget deficit will be decreased, although the official government forecasts of financing needs equal 13% of GNP for 1991, and 3% of GNP for 1992. These forecasts do not seem realistic because of the slow implementation of privatization as well as the inefficiency of the taxation system.
2. Inflation Inflation is forecasted to fall from 23% in 1990 to 16% in 1991. The improvement in productivity that is speculated for 1991, is going to further decrease the inflation to 10% in 1992, a level not reached since 1973.
3. Public Sector Size The public sector continues to dominate a large part of the national economy, because the privatization schema has not been followed strictly. However, the number of public sector employees has decreased by 2.8% the in 1990, the largest percentage decrease during the last fifteen years.

The first priority recommendations of OECD are summarized as:

1. Decrease the number of public sector employees by more than 10%
2. Decrease the public sector expenditures
3. Introduce project finance structures in the required major infrastructure projects.
4. Increase investment concerning environmental protection and improvement projects. Greece ought to preserve its natural opulence which is one of its major national income sources.
5. Improve the efficiency of the taxation system and increase taxation revenues.
6. Promote public/private partnerships by providing the required incentives and by providing the legislative background for private sector participation and initiatives in sectors traditionally dominated by the public sector.

The last significant economic document is the International Monetary Fund (IMF)

annual report⁷. The basic criticisms of the report concern the GNP growth rate and the inflation rate:

1. GNP Growth For the recovery period of 1991-93, IMF forecasts a GNP growth rate, in real values of 3.7%, which is less optimistic than the 6% estimated by EC Officials. The main difference concerns the last year, 1993, which according to EC Officials is going to be the end of the recession, and in which EC forecasts a 3.5% GNP growth whereas IMF forecasts only a 2.5% growth rate.
2. Inflation: According to IMF, inflation is going to fall to 18.2% in 1991, to 14.1% in 1992, and to 7.4% in 1993, which are not at all optimistic compared to the government goals of 16.6%, 12.4%, and 7% respectively. The difference refers mainly to the beginning of the recovery period, when IMF forecasts that budget deficits will not decrease with the rate that the government expects. The result will be that inflation will remain high at the initial stages.

According to IMF, Greece has to concentrate its efforts on exploiting all the financial opportunities offered by EC, if it wants to accelerate its recovery. EC provides a steady stream of zero or low cost funding, which should be invested primarily in infrastructure. The modernized infrastructure and the improved general business climate will provide Greece with the preconditions required for new investments.

The Greek crisis problem cannot be easily confronted. All the above mentioned indicators create an image, viewed from different points of interest, of a country paying for major mistakes made during the last two decades. Therefore, nobody should have been surprised when, according to a study published by Wall Street Journal⁸, Greece was placed 47th

⁷ Sources: "BHMA", Athens Sunday newspaper, 14.7.91, and "NEA", Athens daily newspaper, 2.9.91

⁸ Sources: "THE WALL STREET JOURNAL", 20.9.91, and "BHMA", Athens Sunday newspaper, 6.10.91

in a list of countries which offer investment security. Countries like Cyprus (28th) and Portugal (26th), which are immediate competitors in attracting foreign investments, were placed above Greece.

Greece is characterized, not only by high risk economic indicators, but also provides no incentives to attract foreign investors. As it has been stated by a leading Greek economic journalist, *"The problem with Greece is not so much the shortage of incentives, but the existence of counterincentives"*. During the "Doing Business in Greece" international conference, sponsored by the Greek government, EC, and all the Chambers of Greece, the key counterincentives were summarized⁹:

1. The problematic image of the Greek economy (budget deficits, high inflation).
2. The public sector bureaucracy and inefficiency.
3. The infrastructure worsening and obsolescence (transportation, communications).
4. The obsolete Bank system.
5. The environmental deterioration and the lack of organized investment in environmental protection projects.
6. The lack of well-educated and trained human resources, which constrains the exploitation of limited existing opportunities.
7. The lack of cooperation between the public and private sectors. In fact, in many cases, the private sector is prohibited from participating in certain public sector activities.
8. The inefficient and unjust taxation system.
9. The government's lack of credibility and consistency.

As Mr Argyros, president of the Industrial Chamber of Greece, usually says, *"In Greece, whatever the political origin of the government party, our political and economic system*

⁹ Source: "INFORMATION", Greek monthly management magazine, June 1991

remains a western version of an eastern system".

1.3 Thesis outline

Following this introduction, Chapter 2 discusses the initial assumptions of the study concerning definition of basic terms and focus of interest. First, the definition and the major characteristics of infrastructure projects as are incorporated in this study are discussed. Then, the policy principles and priorities, on which the later research and proposals are based, are presented and discussed.

In Chapter 3, a discussion of the current financing and organizational characteristics of sewerage and wastewater treatment projects in Greece is presented. First, a thorough study of the effective legislation for the specific projects has been conducted in order to specify the boundaries in which the proposal and the available alternatives should be confined. The results are presented both from an organizational and a financial point of view. Second, a study aiming to define the infrastructure financing mechanisms available for the projects of interest from European Community sources has been conducted, and the results are presented. Specific interest has been placed for European Community sources because of the minimal exploitation that Greece makes of the opportunities that it is offered.

In Chapter 4, a brief description and evaluation of the organizational and financial methodologies implemented by Great Britain, Germany, and France in sewerage and wastewater treatment projects is presented. The interesting point that comes out is that although each one follows a different promotion strategy customized to domestic culture, needs, and capabilities, they all base their decisions on the precondition that the projects will be financially self-supported; something considered insignificant by municipal

officials in Greece.

In Chapter 5, a critical presentation of selected infrastructure financing mechanisms and concepts, which are implemented in foreign countries but still lack serious consideration in Greece is provided. Their potential application for sewerage and wastewater treatment projects in Greece is evaluated. The first approach discussed is project finance. The concepts behind it are generalized and considered prerequisites for every successful infrastructure project. Then, the implementation of bonds and user fees as financing tools is discussed. The "hot subject" of privatization could not be overlooked in a discussion concerning the financing of public utilities projects in constrained economies. Four of the most common contractual alternatives under which it is implemented are presented: direct lease, leveraged lease, sale/leaseback, and build-operate-transfer. Finally, the influence of the new infrastructure financing approaches on the role and the responsibilities of a State Development Bank is investigated. A discussion of new needs and trends on an international context, an evaluation of the Infrastructure Bank venture in USA, and the identification of opportunities and responsibilities offered by privatization projects to a State Development Bank, are then presented.

Chapter 6 discusses issues related to wastewater treatment technology. The goal is to evaluate the potential application of the "lime/seawater" chemical process as an alternative to the conventional treatment process. The chapter is divided into two parts. First, a synoptic description of conventional technology implemented in Greece is presented. Definitions of technical terms are clarified and an image of the existing situation is drawn. Second, "chemically enhanced wastewater treatment" is presented and evaluated as a potential alternative for coastal municipalities, which constitute the main focus of the thesis. The emphasis is on extended use of lime/seawater as the chemical coagulant agent.

In Chapter 7, the experience of the Industrial Development Bank of Greece as Technical

Advisor, Financial Advisor, and Fund Manager of infrastructure projects is provided so as to support the argument that it can actually take a beneficiary leading role in the infrastructure business. Finally, the strategic role is presented. The responsibilities and initiatives that ETBA should undertake under the proposed project financing and organization structure are discussed; advantages and disadvantages of the new situation are evaluated.

Finally, in Chapter 8, the conclusions of this study are presented and recommendations are made.

Chapter 2

INFRASTRUCTURE PROJECTS

Chapter 2 discusses the initial assumptions of the study concerning definition of basic terms and focus of interest. First, the definition and the major characteristics of infrastructure projects as these incorporated in the study are discussed. Then, the policy principles and priorities, on which the later research and proposals are based, are presented and discussed.

2.1 Introduction/Definition

The term "Infrastructure" refers to

" facilities and equipment necessary or desirable for the delivery of services to meet social and economic needs ".

("National Rural Community Facilities Assessment Study: Pilot Phase, Final Report", the U.S. Department of Agriculture, 1980) [Vaughan, 1983].

In the dictionary we find that the term "Infrastructure" refers to

" the basic structure on which a country, or organization is built, such as the facilities, services and equipment that are needed for it to function properly ".

("Collins Cobuild English Language Dictionary", 1988)

2.2 Major Categories:

An exhaustive classification of infrastructure projects categories is provided in a study conducted by the U.S. Department of Agriculture. They identified thirty-seven categories under two major headings -service facilities and production facilities. Though the list is very detailed, most studies focus on water and wastewater systems, sewer systems, streets and highways, mass transit and bridges. These categories are reproduced below:

CATEGORIES OF PUBLIC INFRASTRUCTURE

I.SERVICE FACILITIES

Education

- 1.Elementary schools
- 2.Middle schools
- 3.Secondary schools

Health

- 1.Hospitals
- 2.Nursing homes
- 3.Ambulatory (outpatient) care facilities
- 4.Ambulatory dental care facilities
- 5.Ambulatory mental care facilities
- 6.Residential Facilities for
 - a.orphans and dependent children
 - b.emotionally disturbed
 - c.alcoholics and drug abusers
 - d.physically handicapped
 - e.mentally retarded
 - f.blind and deaf
- 7.Emergency vehicle service

II.PRODUCTION FACILITIES

Energy

- 1.Direct Power Suppliers

Fire safety

- 1.Fire stations
- 2.Vehicles
- 3.Communication systems
- 4.Water supply and storage facilities

Solid waste

- 1.Collection facilities and equipment
- 2.Disposal sites

Telecommunications

- 1.Cable television
- 2.Over-the-air television
- 3.Disaster preparedness

Waste water

- 1.Sewer mains and collection system
- 2.Treatment and

Justice

- 1.Law enforcement facilities
- 2.Jails

Recreation

- 1.Community recreation facilities

Transportation

- 1.Railroad facilities
- 2.Airports and related facilities
- 3.Streets, Highways, and Bridges
- 4.Inter- and Intra-Community Transit

disposal systems

Water supply

- 1.Community systems
 - a.Storage facilities
 - b.Treatment facilities
 - c.Delivery facilities

2.3 Characteristics influencing infrastructure decision making

Infrastructure projects are not ends in themselves. Rather, their importance to the economy and to society as a whole derives from the services they offer: the opportunity to improve productivity or reduce costs. Although most easily thought of in a physical form (i.e. a bridge, a subway train) the real output of infrastructure is service: the movement of people and goods; the provision of adequate clean water.

Infrastructure encompasses those activities without which there would be only limited economic activity. In particular, most public works infrastructure projects share several characteristics:

- ** high fixed costs (capital intensive)
- ** a long economic life (durability: once infrastructure facilities are built they usually remain in place for long periods of time, and they are replaced only at substantial cost)

- ** potential to dominate local markets (economies of scale usually characterize the production of infrastructure goods or services)
- ** interaction with other infrastructure projects. Because of their long time horizon and high construction cost, major infrastructure investments usually involve higher risks than the typical industrial investment projects do. Thus, some public sector involvement is often required. Construction periods are substantially longer than most business investments; three to five years or more is common. As a result, construction costs increase. For example, interest costs capitalized during construction can rise dangerously if the duration of the construction phase is prolonged.

The durability of infrastructure facilities requires a distinction between the financing tools appropriate for investments and those appropriate for recurring costs. It is essential that decision-makers are aware that the full costs of a facility include not only the initial investment, but also the annual operating and maintenance costs that it will entail. In many cases, maintenance costs have been overlooked, with the result that municipalities or governments find themselves unable to afford maintenance of facilities for which they were able to raise the initial investment costs.

Investment must all be paid for in one way or another at the beginning, but the benefits accrue over a number of years. Because it is difficult to pay the whole cost at once, investors usually borrow money to cover the initial costs, and they pay it back over the life of the facility as the benefits are being received. Thus long term debt instruments, such as general obligation bonds, revenue bonds, or bank loans, are considered appropriate for investments.

Recurring costs, on the other hand, are both paid for and consumed entirely within a specific and relatively short time period. Borrowing is therefore usually inappropriate,

because it would defer to the long term payments on goods consumed in the short term. Recurring costs, which in the case of infrastructure include operating expenses, maintenance, and debt service, are normally covered with recurring revenue sources, such as user charges or earmarked funds from the general-revenue fund of the locality or government.

2.4 Policy principles and priorities

The increase of capital cost due to high interest rates, especially in countries like Greece which face an economic recession and a considerable budget deficit, makes it imperative that new capital - efficient mechanisms are adopted by the government in order to continue supplying public services under the desired quality standards. Economists refer to this choice as selecting the efficient mix of inputs - land, labor, energy, and capital. Therefore, the first question that has to be answered is, What is the most efficient way of meeting public sector responsibilities?

The next related question raised is, How should required capital expenditures be financed? There are two issues: first, How should costs be shared between the public sector and the private sector ? meaning up to what extent the development of an infrastructure project should be undertaken solely by the public or private sector or should the responsibility be shared; second, What fiscal resources should be used to pay for the construction and maintenance: debt, general revenues, or specific charges and fees ?

There is no single efficient or equitable way of funding an infrastructure project, and even if it were possible to identify the most efficient way to finance a project, the legal and institutional capabilities vary greatly among different countries. What may work in one country may be constitutionally prohibited or institutionally impossible in another.

However, one can identify and devise some general principles to guide an effective financing strategy and help answer the above questions. The principles adopted in the realization and decision making of this study are discussed in the following paragraphs.

A first principle is that, wherever possible, those who benefit from a public facility, a highway or an airport or a hospital, should pay for its development and operation. The amount they pay should be related to the level of their use. In short, those who reap the benefits should bear the costs. However, it is not always possible, through a simple "public pricing" mechanism, to ensure that all those who benefit from a particular project or facility actually pay for it. For example, retail stores and real estate owners may experience a boom in business after a rail service or a new airport is opened, or commuters on congested city roads will be able to get to work more quickly if a new toll road is opened which attracts a portion of the commuters. There are examples of what economists refer to as externalities, meaning benefits enjoyed by those who are not direct users of the facility. In these cases, revenues from other sources should be used to supplement direct user fees.

A second principle is that the cost of an infrastructure project should be amortized over the life of the project and the maintenance and operating costs should not be deferred. This principle naturally follows from the first, since it ensures that there is no intergenerational transfer of net benefits or net fiscal burden. If a long-lived project is financed out of current revenues, then future generations will enjoy the benefits with none of the costs. Conversely, financing a facility with an expected economic life of seven years with twenty -year bonds will shift the cost to future generations. The failure to pay for adequate maintenance in past decades -a very severe problem in Greece- has transferred a fiscal burden from past generations onto the shoulders of today's taxpayers.

A third principle is that the operating and maintenance expenses associated with a project

should explicitly be considered when designing the financing package. Earmarked revenue sources must be sufficient to cover both debt service and ongoing expenses. Otherwise, unanticipated and often large subsidies from general revenues will be necessary. Often it is the case in Greece, project plans contain "big words" about jobs that will result and general tax revenues that will be generated by the new project, but make no provision to ensure that the projected benefits are realized.

Ideally, all infrastructure financing decisions would be made in adherence to these three principles. In practice, however, decisions are made on political as well as economic ground. Nevertheless, setting out the broad principles through which financing should be provided is a necessary first step in the development of a long-term public investment strategy. Once the principles are publicly espoused, then the necessary exceptions will be clearly treated as exceptions, and the arguments to justify them will have to be more convincing. Innovative infrastructure financing decisions are not only technical and economic related decisions, but also include a highly political aspect which requires strong judgement, decisiveness, and the appropriate marketing.

Chapter 3

SEWERAGE AND WASTEWATER TREATMENT FACILITIES IN GREECE: ORGANIZATIONAL AND FINANCIAL STATUS

In chapter 3, a discussion of the current financing and organizational characteristics of sewerage and wastewater treatment projects in Greece follows. First, a thorough research of the effective legislation for the specific projects has been conducted in order to specify the boundaries in which the proposal should be confined, and the available alternatives. The results are presented both from an organizational and from a financing point of view. Second, a research aiming to define the infrastructure financing mechanisms available for the projects of interest from European Community sources has been conducted, and the results are presented. Specific interest has been demonstrated for European Community sources because of the minimal exploitation that Greece makes to the opportunities that it is offered.

3.1 Gross Estimate of Greek Market Size

The immediate needs for sewerage and wastewater treatment in Greece are estimated by the professional environmental engineers to be around 30,000,000,000 drachmas or about \$150,000,000 (see Table 3.1 for a qualitative description of the size of needs). The

TOTAL PROJECT NEEDS PER REGION :

[IN DRACHMAS]

1.	EAST MACEDONIA & THRACE	3,628,000,000
2.	CENTRAL MACEDONIA	5,798,700,000
3.	IPIROS	3,388,000,000
4.	THESSALIA	3,533,000,000
5.	IONIAN SEA ISLANDS	5,775,000,000
6.	WESTERN GREECE	7,579,000,000
7.	STEREA (CENTRAL) GREECE	5,946,000,000
8.	ATTIKI (GREATER ATHENS AREA)	5,417,000,000
9.	PELOPONISSOS	10,580,000,000
10.	NORTH AEGEAN SEA ISLANDS	3,457,000,000
11.	SOUTH AEGEAN SEA ISLANDS	9,152,000,000
12.	CRETE	11,802,000,000

TOTAL : **76,055,700,000**

REMARKS:

- A. THE PROJECT COST INCLUDES
1. SEWERAGE NETWORK CONNECTION
 2. TREATMENT EQUIPMENT
 3. PIPES NETWORK
 4. SLUDGE DISPOSAL
- C. SUMMER 1991: 1\$ = 200 DRACHMAS

TABLE 3.1 : GROSS ESTIMATE OF NEEDS OF COASTAL GREECE FOR WASTEWATER TREATMENT FACILITIES

SOURCE: STUDY FOR THE SUPPORT OF THE E.C. PROGRAM ENVIREG

magnitude of the whole problem is much larger and not easily quantifiable. However, the applications for financial aid made to E.C. for the environmental program ENVIREG, which concerns only coastal municipalities with less than 100,000 people population, raise the size of needs at 76,000,000,000 drachmas or approximately \$380,000,000¹⁰ (Table 3.2).

3.2 Organizational and financial structure of sewerage and wastewater treatment projects and plants in Greece

Each country's infrastructure system is influenced by economic, social and political elements, including economic growth, the banking system and the current maintenance level of infrastructure. The most distinct characteristic of Greece's infrastructure system is that basically all policy and implementation concerned with infrastructure is controlled by the central government. The responsibility for some infrastructure categories is delegated to the state governors and to municipality mayors. Governors are assigned by the government. They are organs of governmental policy, and are 100% financially dependent on the government's subsidy. On the other hand, mayors, who are elected every four years, do not have the financial sources to act independently.

The central government's administrative system is a cabinet system; the exact number of ministries and sub-ministries is flexible, in the range between 40 and 50, and depends on the specific plans of the Prime Minister, who is the head and controller of all ministries. Each ministry manages the respective infrastructure projects. However, major decisions are taken by all the cabinet, and normally express the Prime Minister's will. Laws relating to infrastructure and specifying in detail which level of government is responsible for maintaining and controlling an infrastructure project, are primarily introduced by the

¹⁰ In the summer 1991: 1\$ = 200 drachmas

MIDDLE SIZE URBAN AREAS WITHOUT WASTEWATER TREATMENT FACILITIES

KOMOTINI	THIVA
DRAMA	KARPENISSI
SERRES	ARTA
KILKIS	PREVEZA (O.S.)
NAOUSSA	IGOUMENITSA
EDESSA	MEGARA
ITEA	XILOKASTRO
FLORINA	AIGIO
AGRINIO	PATRA (O.S.)
KOZAN	IPIRGOS
KIATO	MEGALOPOLI
NAFPAKTOS	ARGOS (W.I.P)
TRIPOLI (W.I.P)	NAFPLIO (W.I.P)
RODOS (O.S.)	HIOS
MITILINI	SAMOS

IONIAN SEA ISLANDS

CYCLADES (i.e. MYKONOS, SANTORINI)

CRETE (i.e. IRAKLIO, HERSONISSOS, IERAPETRA)

REMARKS:

1. THE REFERENCE OF THE CITIES IS REPRESENTATIVE OF THE WHOLE GEOGRAPHIC AREA OF GREECE
2. W.I.P. = WORK IN PROGRESS
3. O.S. = ON SCHEDULE

TABLE 3.2 : LIST OF MIDDLE SIZE URBAN AREAS WITHOUT WASTEWATER TREATMENT FACILITIES

SOURCE: ETBA - ENGINEERING DEPARTMENT

cabinet and voted by the parliament on a majority basis. This vote has a completely typical character, since the government party always holds the majority of the parliament, and since representatives are traditionally not differentiated from the party-president's - and Prime Minister- decisions.

Besides legally controlling the infrastructure system, the central government also exerts financial control. It governs the amount of investment on infrastructure by the central and local authorities and develops a financial plan every five years. The different types of infrastructure projects are approved by the cabinet and are included in the national budget every year.

The legislative framework which controls the functioning of sewerage and wastewater treatment infrastructure projects, and the available financial sources for such projects in Greece are described in the following sections.

3.2.1 Organizational status - Legislative framework

The Law 1069/80 constitutes the fundamental framework describing the foundation, operation and responsibilities of the Regional Corporations of Water Supply and Sewerage (RCWSS). Their description states that although, as municipal corporations, they are regarded as legal entities of public benefit, RCWSS must function according to the rules of the private sector, unless a specific Law states the opposite.

Objective of the RCWSS is to be responsible and manage all kinds of activities concerning the sewerage and water supply network of all the municipalities of Greece

*with population greater than 15,000 people, except for Athens, Thessaloniki and Volos*¹¹. The RCWSS responsibilities include the design, the construction, the management and the operation of the water supply and sewerage networks, and of the wastewater treatment plants for the geographic area of their competence. Their responsibilities can be expanded to include the city solid waste gathering, transportation, and treatment.

The Law 1416/84, article 29, defines that municipality projects are constructed under contracts which have been awarded with open bidding and according to the decisions of the municipality council members. Article 30, paragraph 4, states that the engineering design must be accomplished and approved by the technical department of the municipality, and if such does not exist, by the technical department of the state. For projects whose budget exceeds 100,000,000 drachmas, or \$500,000, the engineering design has to be approved by the technical department of the Ministry of Internal Affairs¹².

The Presidential Decree 171 15.5/2.6.1987 defines the participants of a municipality project and their responsibilities:

1. "Employer" or "Owner of the project" is the municipality or municipal corporation which executes the project.
2. "Head of the project" or "Owner's representative" is the competent municipality, or municipal corporation, department which has been assigned by the council the

¹¹ Athens is the capital, Thessaloniki is the second largest city, and Volos is the most significant eastern commercial port connecting Greece with eastern markets. All three had government companies for sewerage and water supply before the Act 1069/80.

¹² The Ministry of Internal Affairs is responsible for the management, financing and organization of states and municipalities. The Minister proposes the new state governors, and the Prime Minister reviews and approves their selection.

responsibility for the project realization.

3. "Project Manager" is the technical department of the municipality, or of the municipal corporation, and if such does not exist, the technical department of the state.
4. "Inspector" is the technical department of the municipality, or of the municipal corporation, and if such does not exist, the technical department of the state.
5. "General Contractor" is the construction company, which has been selected with open, and mostly lump-sum, bidding by the municipality, or municipal corporation, council.
6. "Technical Advisory Committee", both for the design and construction phases, are the Technical Committee for Municipal Projects of the state and the Technical Committee for Municipal and State Projects of the Ministry of Internal Affairs.

The Law 1416/84, article 11, defining "Program Contracts", provides the municipalities and their corporations with the potential to enter into Program Contracts with government corporations (as they are defined in Law 1256/1982, article 1, paragraph 6), for the design and realization of construction and development projects, and for the supply of special and specific services. The Hellenic Industrial Development Bank is one of the eligible government corporations.

This fact, or discovery, was the key point of the proposed structure. It allows the Bank take initiatives in the financing and management of the projects, by keeping part of the tasks for its own departments and by contracting out to, or even cooperating with, the private sector the major part of the project tasks, thus promoting the trendy idea of public/private partnerships, which will be further discussed in chapter 5. .

The basic characteristics of a Program Contract are:

A. Description of the Participating Parts

Eligible parts:

1. municipalities
2. municipal corporations
3. public corporations, as they are defined in Law 256/1982, article 1, paragraph 6
4. associations of municipalities
5. producers', agricultural, and any other kind of public co-operatives
6. the Technical Chamber of Greece, the Chamber of Trades, the Chamber of Industry etc.

B. Contract Goals

General Categories:

1. design and construction of projects
2. study and realization of development programs and plans
3. general consulting and service rendering; these have to be clearly defined in contract

C. Contents

1. definition and description of contractual goals
2. each party's rights and responsibilities
3. existing financial sources at the time of the contract
4. budget estimates
5. contract realization schedule and forecasted cash-flows

D. Financing of the Project¹³

Basic sources:

1. Public Development Account of the Government budget (Grants)
2. Other project specific Government sources, Grants or Loans
3. Participants' budgets

¹³ This applies in case the financing is not part of the contract goals, however, even in such a case, this clause implies that a Program Contract structure remains eligible for the normal government financing sources through the participating parties. However, the funds will be raised for a specific Program Contract and will be managed under the terms of the contract.

The marketing of the Program Contract structure is going to emphasize the following potential advantages that it offers:

- more efficient organization and management of the project realization vehicles
- more efficient use of the public development funds, as well as use of new and more flexible financing mechanisms currently used in the private sector
- a better organized development policy, which may provide valuable economies of scale
- elimination of the existing bureaucratic mechanisms
- more efficient human resources management. The participating parties are allowed to share qualified personnel for the needs of the specific contract, something which otherwise would require time-consuming and bureaucratic procedures of the public sector. Moreover, the non-public character of the resulting organization allows for provision of a modern reward system, which may attract better qualified employees
- it promotes public/private partnerships, by providing the legal basis for an active participation of the private sector in the design and implementation of infrastructure development projects.

3.2.2 Financing options - Legislative framework

3.2.2.1 Grants through the Public Development Account (PDA)

The government grants are streamed to RCWSS through the Public Development Account¹⁴. The grants, as the Law 1069/80 clearly states, can be only used for the design, construction, reconstruction or expansion of water supply, sewerage and waste

¹⁴ The PDA is part of the government annual budget and it concerns all sort of public projects. The Minister of Internal Affairs, as functional head of the municipalities, defines the annual capital amount available for such projects.

water treatment projects. The contribution of the grants to the total project cost cannot be higher than 35%, and are available as long as the annual provision is not consumed. An interesting and very significant point is made in Article 14, where it is stated that an RCWSS may use the grant only after it has ensured the remaining part of the financing, either through its own revenue sources or through borrowing.

The last four years though the needs have raised significantly, the funds provided by the PDA have remained nearly constant, in disinflated values (Table 3.3).

3.2.2.2 State Budget

Municipalities which have less than 15,000 people population are not under the Law 1069/80 provisions; therefore they cannot take grants straight from the PDA. However, they can be financed from the state project budget, whose main source is again the PDA. In this case, where RCWSS are not legally provisioned, the whole responsibility of project realization, organization, and operation is assigned straightly to the elected mayor and council. The state ought to allocate the available capital to the appropriate projects and control their consumption, playing for the small communities the role, on a micro level, that the Ministry of Interior Affairs holds for the larger communities.

3.2.2.3 Deposits and Loans Fund

The Deposits and Loans Fund (DLF) offers loans to RCWSS, under special economic terms, for the design and construction of new projects, for investment in existing facilities, for new equipment procurement, and for site expropriation.

As soon as an RCWSS' application for a PDA grant is approved by the Ministry of Internal Affairs, the RCWSS becomes eligible to apply for a loan from DLF in order to

**PUBLIC DEVELOPMENT ACCOUNT:
WATER SUPPLY, SEWERAGE AND WASTEWATER TREATMENT PROJECTS
[IN DRACHMAS]**

	1988	1989	1990	1991
TOTAL AMOUNT	9,500	13,400	17,000	26,000
(-) WORKS FOR ATHENS WATER SHORTAGE	0	0	-3,000	-9,000
NEW TOTAL	9,500	13,400	14,000	17,000
DISINFLATED VALUES (1991 VALUES)	16,400	19,300	16,800	17,000

REMARKS:

1. AVERAGE ANNUAL INFLATION: 20%
2. THE FUNDS OFFERED FOR THE ATHENS WATER SHORTAGE PROJECTS ARE CALCULATED FROM SOURCES OF THE MINISTRY OF NATIONAL ECONOMY
3. THE ABOVE FIGURES INCLUDE FUNDS FOR ATHENS, VOLOS AND THESSALONIKI
4. SUMMER 1991: 1\$ = 200 DRACHMAS

TABLE 3.3 : PUBLIC DEVELOPMENT ACCOUNT GRANTS

SOURCE: MINISTRY OF NATIONAL ECONOMY

raise the remaining capital. The approval of the loan is a typical procedure, as long as the RCWSS provides the required typical supporting documents (Table 3.4). In the case that an RCWSS does not get a PDA grant, it can still apply for a DLF loan for up to the 80% of the total project cost. The need for an additional funding source is then created.

The DLF has an earmarked financial department which controls the financial part of the loan applications and does a feasibility study for the project, if it has not been done. The technical control is left to the complete responsibility of the Ministry of National Economy, which is the final judge for the PDA grants. If a project reaches the DLF without having been accepted for a PDA grant, the loan application and the project technical description are sent to the technical department of the Ministry of Internal Affairs for control. This procedure becomes highly bureaucratic and slow; every mayor who has promised to his voters a new sewerage network can apply for a loan, even without a complete technical design, and without being filtered by an initial -internal to DLF- prequalification mechanism.

The general terms of the loans being currently approved are:

- interest rate: a fixed interest rate, which is defined by the Bank of Greece, is used for the whole lending period. The last five years it has remained constant at 19%.
- lending period: fifteen (15) years for construction and eight (8) years for equipment procurement. Moreover, an initial grace period with interest capitalization, which is equal to the construction period, but cannot exceed four (4) years, is offered.
- capital withdrawal procedure: the withdrawal of the borrowed capital is done simultaneously with the actual expenditures and after the following inspection:
 - a) inspection of the RCWSS expenditures certificates by the Ministry of National Economy
 - b) inspection of all the financial transactions by the Controller assigned by the

**TABLE 3.4 DEPOSITS AND LOANS FUND:
SUPPORTING DOCUMENTS FOR A LOAN APPLICATION**

I. For the design and construction of sewerage and wastewater treatment projects

- a) Administrative decisions and supporting documents of legalization
 - aa) the Presidential Decree of the foundation of the RCWSS
 - ab) decision of the municipality council concerning the appointment of the President and the Members of the Board of Directors of the RCWSS
 - ac) decision of the board of directors describing the purpose of the borrowing and the amount required
 - ad) organogram of the RCWSS and general description of its functioning (administrative, financial, technical, and maintenance departments, equipment currently owned). Personnel currently employed and hiring schedule for the next years (# of new employees, salaries).
- b) Financial information
 - ba) detailed balance sheet and income statement of the last year
 - bb) detailed description of RCWSS credit history: past and existing loans, schedule of debt payments
- c) Technical issues
 - ca) design of the project, budget and cash-flow for the construction phase
 - cb) construction schedule and completion time estimate
- d) Other relative information
 - da) permanent population that the project intends to service, annual variance of demand, population growth forecast
 - db) register number of the approval for financing of the project through PDA, and the actual amount approved by the PDA
 - dc) if the project budget exceeds 1,000,000 ECU then an international bidding is obligatory. In this case a copy of the EC Committee newspaper in which the bidding was announced, is required
 - dd) energy consumption forecast

II) For the procurement of new mechanical equipment

- a) Everything described above in (a), (b), and (d)
- b) The procurement contract showing detailed cost analysis

SOURCE: SAVINGS AND LOANS FUND: FINANCIAL DEPARTMENT

Bank of Greece.

The total capital lent to RCWSS' by the DLF has been growing during the last ten years, reaching the level of 33,000,000 drachmas. On the other hand, the mature-due responsibilities of the RCWSS' have already reached the 4,000,000 drachmas, which becomes an alarming point if one considers that the large majority of these loans was given during the last five year. A serious danger of inefficient spending of public funds can be distinguished. The problem is not so much in the existing rules, as it is in the implementation of the rules.

3.2.2.4 User Fees as implemented in Greece for sewerage and wastewater treatment services

The Law 1069/80 defines the revenues of the RCWSS generated from user fees. The basic characteristics of each category are:

A. Special Fees used exclusively for the design, construction, renovation or expansion of water supply, sewerage and wastewater treatment projects.

a) Special Fee for the design, construction and expansion of water supply, sewerage and wastewater treatment projects (Article 11).

- * it is imposed for one decade, starting from January 1st of the year following the foundation of the RCWSS
- * it is set equal to 80% of the value of consumed water
- * the same fee may be imposed in the case of a "major" expansion of the RCWSS

b) Special Fee related to Real Estate Income

- * it is imposed for one decade, starting from January 1st of the year following the foundation of the RWSS
- * it is set equal to 3% of the before-tax income generated by real estate assets which are included in the service area of the RCWSS, indifferently to whether they are

using the facilities or not. If the asset is used by its owner, the owner's before-tax income is set equal to the income generated by a analogous asset in the same area

- * the same fee may be imposed in the case of a "major" expansion of the RCWSS
- * the Special Fee is payable to the local Tax-Authorities together with the regular income tax. It is returned to the RCWSS at the end of the year after a resolution of the Ministers of Economic Affairs¹⁵ and of Internal Affairs

Remark: as this special fee is returned to the RCWSS through the Tax Authorities, it can be used by an RCWSS in a potential borrowing agreement as a fund dedicated to interest and loan capital repayment. The lender may receive the payments straightly through the Tax Authorities, without the intervention of the RCWSS. The risk inherent in such a proposal is generated by the bureaucracy of the Greek public authorities.

B. Lump Sum Connection Fees

All the imposed connection fees are paid by the users in advance. Thus they become a significant revenue at the capital intensive early project phase.

- a) fee for the connection with the water supply network
- b) fee for the connection with the sewerage network
- c) fee for the connection of the sewerage network with the wastewater treatment plant.

A similar fee is imposed whenever the treatment is upgraded

C. User Charges

The standard fees paid by the users on a regular basis during the operation phase.

- a) fee for the water supply service. It is set proportionate to the volume of water consumed.
- b) fee for the sewerage and the wastewater treatment services. It is calculated as a percentage of value of the consumed water. The percentage depends on the operating

¹⁵ The Minister of Economic Affairs has the role of the Chief Accountant of the government

costs of existing facilities.

- * all the user charges are received by the RCWSS on a monthly or bimonthly basis in what is called the "Water Bill"
- * the Law 1069/80 states that the user charges **MUST** be at least adequate to cover the following expenses:
 - personnel salaries
 - operating and maintenance costs
 - debt payments
 - provision for technology, performance, and size upgrades.

D. Various other fees

- a) fees paid by individuals or corporations for a connection by priority
- b) fees paid for the use of the meter-facility which measures the water volume consumed

E. Fees paid for the use of the wastewater treatment products

Two products are currently exploited by some RCWSS:

- a) recycled water, which is supplied for agricultural use. Its importance is very high especially for areas with water shortage problems
- b) sludge, which is sold for fertilization use.

3.3 European Community fund-raising opportunities

European Community's objective is to adopt a common environmental policy for all the country-members. EC accepts that environmental protection and caring constitute an immediate need, as life quality is highly interrelated with environmental quality, and as it is anticipated that the "1992" union, above its positive economic results, may further endanger the ecology balance in the already damaged environment of most EC countries.

The EC Committee, with the approval of the Third Program of Action in 1983, defined a global strategy of environmental damage prevention and of natural resources protection. Later, with the Fourth Program of Action (1987-1992), EC established the environmental protection as fundamental substitute of every economic and social development policy, by including it in the list of the six Priority Action Axes (Table 3.5). Finally, it is significant to mention that the EC Committee has decided to establish the European Fund for the Environment (EFE), an institution whose exclusive task will be to find new financial sources for environmental projects.

3.3.1 European Investment Bank

The European Investment Bank (EIB) -established in 1958, with the European Economic Community (EEC) foundation treaty- is the main lending source of EC. EIB functions independently to all the other EC organs. The basic elements characterizing its activity are:

- Members: the twelve EC country-members, which contribute to its capital
- EIB Objective: the funds provided by EIB aim to balance the development between different regions or countries in EC, by financing regional development and modernization projects. Infrastructure projects, and especially environmental projects, are included into the EIB list of prioritized objectives
- Financial Sources: EIB's revenues come from public issues or private placements both in EC and in international markets.

EIB offers two different types of loans:

1. Independent Loans:

Usually they cover up to the 50% of total investment cost. In absolute numbers no upper

**TABLE 3.5 EUROPEAN COMMUNITY - FOURTH PROGRAM OF ACTION
THIRD PRIORITY**

C. Promotion of investments in environmental protection

The European Investment Bank in cooperation with the European Community Committee provides loans for the construction of wastewater treatment plants, for the transfer of new technology, for the realization of plans concerning improvement of water quality, and for studies concerning environmental protection of Mediterranean countries. For the Mediterranean countries additional financial support is provided through the European Fund for Regional Development and the EC Programs MEDSPA and ENVIREG. One of the EC high priorities is the establishment of the European Fund for the Environment, which will increase the existing financial sources for environmental projects. Moreover, the country-members are urged to provide extra financial support for municipalities or corporations which intend to invest in environmental protection. Finally the European Community will impose very high fines to corporations which are proved to have caused environmental pollution.

SOURCE: EUROPEAN COMMITTEE

- b) **Borrowing period:** for infrastructure and energy projects the borrowing period is usually between eight (8) and twelve (12) years, with a variable initial grace period.
- c) **Interest Rates/Currency:** the interest rates paid are fixed for the whole borrowing period and very competitive compared to the ones existing in the international financial markets. However they include a fee for the services of the intermediate F.I. .The currency of the loan is mostly the local currency of the borrower.
- d) **Guarantee:** the F.I. guarantees to the EIB the repayment, therefore EIB is indifferent to the guarantees given to the F.I. by the borrower.

The exploitation of the funding opportunities offered by the EIB under special economic terms, and the matching of these opportunities with the financial needs of municipal corporations, municipalities, or even industrial corporations for sewerage and wastewater treatment projects becomes a critical task for Greece. It is alarming that according to the EIB Annual Report, which was issued in Brussels, Greece for the period between 1986 and 1990 received a very low, proportionally, amount of loans compared to the other EC countries. Greece has received 1,015.5 millions ECU for regional development project, 80.2 millions ECU for infrastructure projects of high EC interest, and 329.8 millions ECU for environmental protection projects, which, for example, are lower than the ones received by Portugal in absolute terms, or Italy in proportional terms (Table 3.6). The cause of this phenomenon is attributed by EC officials partially to the fact that no practical and specific interest was demonstrated from the Greek part, and partially to the fact that no official briefing was issued by the Greek government describing borrowing potentials¹⁷. A new structure for the whole realization procedure of projects seems to be required. One which would promote, or at least permit, the participation of organizations which will be able to exploit all the potential financial opportunities

¹⁷ Source: "NEA" Athens newspaper, 13.6.91

limit exists. For practical reasons EIB prefers not giving loans lower than 2,000,000 ECU¹⁶, though no low limit exists.

a) Borrowing Procedure: no standard procedure exists, the loans are the result of case-by-case direct negotiations between EIB and the investors

b) Borrowing period: for infrastructure and energy projects the borrowing period can extend up to fifteen (15) years

c) Interest Rates/Currency: most often fixed interest rates are used, however nothing restricts the use of floating rates. Reflecting the EIB non-profit character, the interest rates are set very close to the actual cost of capital for EIB, and are independent to the type and region of each project. The loan repayment is done with annual or semi-annual payments -interest plus capital- in the same currency as the loan capital. An initial grace period exists, whose length is dependent to the length of the project realization phase. There are no limits in the type and mixture of the loan currency, as long as EIB can raise the required amounts in the desired mixture.

d) Guarantee: a "satisfying" level of guarantee is required. It can be any kind of formal guarantee issued by a Government, Bank or Financial Institution with high credibility.

2. Total Loans through Intermediate Financial Institutions:

Total Loans are available for investments whose total cost is not over 20,000,000 ECU.

a) Borrowing Procedure: EIB agrees to provide a Financial Institution (F.I.) with a constant credit limit. The F.I. then has the obligation and the right to manage the available credit and finance investments of lower cost, which satisfy the EIB criteria. These secondary loans can provide up to 50% of the total investment cost. In fact F.I., which has a better image of the local constraints, acts as a local intermediate of EIB. The F.I. receives applications for borrowing on behalf of EIB, filters them, and submits the ones initially approved to EIB for the final approval.

¹⁶ Exchange rate (29.9.91): 1.2136 \$ = 1 ECU

**LOANS GIVEN TO EC COUNTRIES BY EIB BETWEEN 1986 AND 1990
(INDEPENDENT AND TOTAL LOANS)**

(IN MILLIONS ECU)

COUNTRY	REGIONAL DEV/MENT	INFRA/TURE OF HIGH EC PRIORITY	ENVIR/MENT	ENERGY
BELGIUM	154.6	6.0	10.4	-
DENMARK	831.1	704.3	85.3	963.5
GERMANY	1,086.7	65.1	1,270.4	508.5
GREECE	1,015.5	80.2	329.8	422.9
SPAIN	3,347.4	2,036.3	642.9	553.7
FRANCE	3,389.0	1,441.0	182.2	294.0
IRELAND	945.9	280.2	93.4	130.5
ITALY	10,492.6	1,334.3	2,625.0	4,051.5
LOUXEMBURG	11.8	19.8	-	-
HOLLAND	359.7	355.7	3.0	3.2
PORTUGAL	2,467.4	245.3	71.9	467.7
UN.KINGDOM	2,938.4	1,334.6	1,758.5	1,973.5
	27,040.1	8,075.8	7,072.8	9,567.5

TABLE 3.6 : EIB LOANS 1986 -1990

SOURCE: "NEA" NEWSPAPER, 13.6.91

3.3.2 European Fund for Regional Development

The European Fund for Regional Development (EFRD) is the main organ of the EC regional development policy. It participates to national, state, and local economic development plans which reflect the EC policy for infrastructure projects and industrial plants. One of the three EFRD priorities refers specifically to infrastructure projects, considering them the prerequisite for all regional development activities. Among infrastructure projects, environmental projects, and therefore sewerage and wastewater treatment facilities, are of high priority.

EFRD funds are streamed to regional investments primarily through EC Programs, which are activities which concentrate their interest in a specific development subject. The currently active EC environmental Programs concerning sewerage and wastewater treatment facilities are:

1. Program MEDSPA: it concerns projects aiming to the environmental protection of the Mediterranean Sea.

Main Objectives:

- a) financial support and promotion of new projects which contribute to the protection or amelioration of the Mediterranean Sea environment and which reflect the EC environmental policy for the specific area
- b) financial support to studies which contribute to the public realization that environment and life quality are highly interrelated
- c) promotion of the integration of the efforts aiming to Mediterranean Sea environmental protection made by different EC countries.
- d) promotion and financial support for transfer of technology able to improve the performance of environmental projects. In fact, technology is one of the main priorities included in all EC Programs.

Main Priorities:

a) for coastal municipalities of less than 100,000 people population, which in fact includes all coastal Greek municipalities, and small islands: projects concerning sewerage networks, and treatment of liquid and solid waste

b) gathering, treatment, and recycling of the sludge resulting from wastewater treatment

Budget: 37,000,000 ECU

Duration: 1990 - 1992

2. Program ENVIREG: it reflects the EC regional policy concerning environmental protection for coastal municipalities with less than 100,000 people population.

Main Objectives: this Program is highly related to the MEDSPA Program, and aims to ameliorate the environmental conditions in certain areas in order to provide additional incentives for economic development activities and attract new investors. It primarily concerns areas which face serious modernization problems and have few public funds available for sewerage and wastewater treatment projects, representing the basic environmental infrastructure.

Main Priorities

a) basic infrastructure projects: sewerage network, primary treatment facilities, supporting sewerage network connecting the city network with the treatment facility

b) secondary treatment projects in areas where the sea is their primary income generating asset (modernization of summer resorts)

c) sludge treatment and water-recycling projects

Budget: 500,000,000 ECU

Duration: 1990 - 1993

The percentage of the contribution of EC Programs to the total public cost is normally between 50% and 55% , and takes the form of low-interest loans or grants. The capital is withdrawn in two advance payments which do not exceed the 80% of the total financial support and the remaining capital is given in partial-payments during the project

realization phase.

The key issue of the Program financing structure is that the local government or a government-owned corporation have to act as an intermediate both for the application and project selection phase, and for the loan withdrawing phase. EC does not deal straightly with private corporations. In Greece, until now, the government was the manager of all the programs. This resulted in low percentages of capital withdrawing and in inefficient use. Therefore, a strong need arises for a public corporation qualifying to undertake a leading role as financial advisor and/or fund manager of the government -at all levels from central to state and municipality authorities- for infrastructure projects. It will have the following responsibility:

- optimize the (withdrawn / available) ratio for the capital offered by EC Program. Such a goal presupposes the complex task of early identifying the projects which can be supported by an EC Program, and of defining and presenting them in the appropriate way so as to be approved, and
- manage and control the use of the withdrawn capital. EC keeps the right to demand a return on the offered funds, if they are not used efficiently. In fact, this is the case with the first loans given to certain Greek public corporations during the early '80's.

Chapter 4

SEWERAGE AND WASTEWATER TREATMENT FACILITIES ORGANIZATION AND FINANCING STATUS IN OTHER EC COUNTRIES

In chapter 4, a brief description and evaluation of the organizational and financing methodologies implemented by Great Britain, Germany, and France in sewerage and wastewater treatment projects, follow. The interesting point that comes out is that although each one follows a different promotion strategy customized in domestic culture, needs, and capabilities, they all base their decisions on the precondition that the projects will be financially self-supported; something considered insignificant by municipal officials in Greece.

It is essential to notice that the countries that are going to be discussed have, up to a certain extent, an organized system of sewerage and wastewater treatment facilities. Their needs are basically limited to projects concerning the upgrade or the extension of the existing plants. Furthermore, one should notice that privatization, where referred to, mainly concerns the operation and maintenance phase. Implicitly, however, the whole idea contributes to the structuring of the organizations according to private business criteria, so that they can be self-financed.

A particular emphasis will be given to Great Britain for two reasons: first, because it is

a key member of E.C., and second, because of its recent transition from municipality ownership and operation to privatization. The British case has a special interest, if one considers the traditionally conservative British people, who have been used to paying minimal, if any at all, fee for the specific kind of services and now they have to treat the companies offering these services as profit-looking businesses.

4.1 Great Britain

In Great Britain Water, Sewerage and Waste Water Treatment are services provided by Regional Water Authorities. Under the current structure each Authority services a large community, compared to the oldest system which divided the country to smaller and more independent communities and resembled more to the American system.

Until the mid-80's, these Authorities were owned and operated by the local municipalities and their financing was realized through the Public Works Loan Board (PWLB). The PWLB is a central government body, which provides to local authorities access to debt financing at slightly below market rates. Its implicit importance is that it stands as a guarantor for all local default, assuring the borrowers for repayment of the loans. The advantages of this system is that the government :

- implicitly filters the projects and tests the level of need and economic viability of the requested loan support, and
- does not have to rely on general obligation bonds, or immediate backing to support the infrastructure loans.

The Water Act 1989 provides for a major change in the operation of the water industry in England and the Wales, including the privatization of the nine regional authorities in England and the Welsh Water Authority, and new powers for the protection of the water

environment. In Scotland responsibility for public water supply, sewerage and sewage disposal continues to rest with nine regional and three islands councils, while in Northern Ireland it will continue to rest with the Water Service of the Department for Northern Ireland. The turnover of the water authorities in 1988-89 totalled nearly 3,200 million pounds¹⁸ and they achieved operating profits of almost 1,200 million pounds.

Under the 1989 Act the water authorities obtained responsibility for the management of water services, the development of water resources, water distribution and supply, the prevention of pollution, sewerage and waste water treatment. The government, before calling for private sector participation, reconstructed the finances of the companies, writing off 5,000 millions pounds and, through subscription for new shares, injecting cash into most of the companies to a total of some 1,570 million pounds.

The flotation of the ten water and sewerage companies was one of the largest examples of privatization, the net proceeds totalling about 3,400 million pounds. Some 2.7 million applications were made for shares and the issue was considerably oversubscribed.

Share incentives were given for employees and customers of the companies. Eligible employees were entitled to free shares worth about 70 pounds at the offer price and additional amounts related to length of service. About 37,500 employees became shareholders, some 86 percent of the companies' total staff. Customers who purchased shares in their local water company were entitled to additional bonus offers. Investors who purchased shares in companies of which they were not customers received some bonus offers as well. However, each investor is limited to receiving these incentives in only one company. The articles of association of each company seek to prevent for a period of five years to December 1994 the ownership or control by any one person of 15

¹⁸ Exchange rate (29.9.91): 1.7288 \$ = 1 Pound

percent or more of the voting rights. This cannot be changed without the consent of the government, which holds a special share in each company.

A Director General of Water Services has been appointed, with responsibility for overseeing a system of economic regulation of the industry and ensuring guaranteed standards of service. The Director General's functions include monitoring the performance of the companies concerning their duties as laid down in the Act, and protecting the interest of the customers, primarily through a price control regime. The Director General heads the Office of Water Services, which carries out these duties. Under the system of price controls the formula for limiting increases in water charges is linked to the Index of Retail Prices ($RPI + K$), with K being set initially by the appropriate Secretary of State (subsequently by the Director General) and varying between each company. It takes account of capital investment requirements and duties under the Act. K averages 5 percentage points for the first five years of operation.

4.2 Germany

In Germany, the responsibility for the financing, construction, and operation of infrastructure facilities and services, such as sewerage and wastewater treatment, is delegated to Regional Companies, which are owned by the local municipalities. The reason why each Regional Company is usually supported by, and responsible for, more than one municipalities, is the recognition of the fact that infrastructure projects frequently become financially attractive and economically viable only if they are planned to serve more than one communities (economies of scale).

The Regional Companies are financed through:

- user fees, which are calculated to provide at least a break-even financial result,

- grants, which mostly come from the state government and not the federal government,
- initial financial contributions from the budget of the participating municipalities, and
- borrowing, especially bank borrowing through municipal savings banks, instead of following only the common bonds market approach.

The new element in the German approach is the introduction of municipality savings banks in infrastructure financing. Due to the fact that the structure of the German financial system in general limits the investment alternatives for small investors, these banks, which are owned by municipalities, receive deposits from individuals at relatively low interest rate. Therefore, they can make loans to municipalities at competitive interest rates. Although they are not obliged to make loans for infrastructure finance, the municipality-ownership helps the situation. However, as one would expect, the government has imposed a limit on their capital percentage that can be lent for infrastructure financing in order to protect the depositors.

In order to consider implementing a bank borrowing approach to other countries, one would have to examine:

- whether it would be value-adding for the economy to require from banks, insurance companies, pensions funds, and other financial institutions to start lending part of their available capital for infrastructure purposes, under special economic terms, instead of investing in other economic activities,
- the role of the traditional hard-working and reliable German culture, which is reflected to the structure and operation of the Regional Companies, and which renders them reliable borrowers, to the successful adoption of such a strategy, and
- whether adequate capital is provided for the required infrastructure compared to the capital streamed to the rest economic development activities. If a misbalance

exists, the government may have to provide the municipalities with implicit credit backing by imposing the banks and other financial institutions to "lend" a percentage of their available capital for infrastructure purposes.

4.3 France

In France, sewerage and wastewater utilities are traditionally run by private companies on behalf of local authorities and under the control of an elected mayor. The fundamental elements of such businesses are localized management, long-term contracts -12 to 30 years- tight regulation, and competition. Privatization implemented in France can be viewed as government regulated, locally managed utility management. It is not a chance event that the three largest French companies in the water business were the only foreign companies to pick up water assets in Britain.

The private companies offer to the municipalities solutions to many of the problems confronted by similar companies in other parts of the world:

- a flexible organizational and administrative structure,
- financial backing and access to financial markets otherwise too expensive for a municipality, and
- the overall accumulated experience in operation and maintenance of similar projects, both local and international.

The philosophy of the implemented system is better reflected by the words of the chairman and guiding force of one of the three major French companies in the water business [Caulkin, 1990]:

"I believed that the basic services that we supplied -management of water and energy resources, city cleaning and wastewater treatment management- were

destined to become increasingly vital components of the quality of life in modern communities. ... City infrastructure would need to be renewed, and services managed in flexible, cost effective ways. ... First those needs would be international as environmental pressures and development growing pains increase. Second belying the traditional service image, they would require an increasingly high technology content. ..."

Chapter 5

INFRASTRUCTURE FINANCING ISSUES AND MECHANISMS

In chapter 5, a critical presentation of selected infrastructure financing mechanisms and concepts, which are implemented in foreign countries but still lack serious consideration in Greece is provided; their potential application for sewerage and wastewater treatment projects in Greece is evaluated. The first approach discussed is projects finance. The concepts behind it are generalized and considered prerequisites for a every successful infrastructure project. Then, the implementation of bonds and user fees as financing tools is discussed. The "hot subject" of privatization could not be missing in a discussion concerning financing of public utilities projects in constrained economies. Four of the most common contractual alternatives under which it is implemented are presented: direct lease, leveraged lease, sale/leaseback, and Build-Operate-Transfer. Finally, the influence of the new infrastructure financing approaches on the role and the responsibilities of a State Development Bank is investigated. A discussion of new needs and trends on an international context, an evaluation of the Infrastructure Bank venture in USA, and the identification of opportunities and responsibilities offered by privatization projects to a State Development Bank, are then presented.

5.1 Project Finance

5.1.1 Introduction/Definition

The budget deficits present in many developed and developing countries, the international economic recession, and the international debt crisis, together with the burgeoning costs of such capital intensive projects as the major infrastructure ones (transportation, energy), have escalated the demand for financing beyond the means of traditional sources. A partial answer to the financing needs of the public and private sectors in both the domestic and international markets lies in more extensive application of the complex process known as project finance.

Project Finance is a method of financing an enterprise based on the cash flows that the project is expected to generate. Generally, it means that the debt provided to finance a project will, in varying degrees, be serviced and repaid out of the revenues derived from that project. Thus, although the levels of recourse and the types of support given may vary, lenders in a project finance will always be taking some degree of credit risk on the project itself. This means that, in assessing whether to finance a project, a lender must consider both its technical feasibility and its economic projections. Because of the nature of this type of finance, the performance, credit, political and technical risks of a project must all be evaluated. The concept has a long history, having been used to construct the Suez Canal, Power plants in Turkey and other Developing countries, Toll roads in Malaysia, and the Eurotunnel project. Project finance is viewed as a method to finance the construction of major infrastructure projects without the need for direct sovereign guarantee on the loans; it is being promoted wherever the central government is reluctant to go after new foreign debt, and/or the markets are reluctant to provide it. Generally, it is most appropriate for projects characterized by high capital requirements, by large and complex risks, and by a consequent inability to raise sufficient funds from conventional sources.

5.1.2 Project phases and corresponding risks

Many of the projects that are seriously considered are not successfully completed. Some of the causes for this are delays in adoption and completion (with consequent delays in the contemplated revenue flow), technical failure, and poor management. The key to success is to identify and manage these risks. Therefore, the complexity and magnitude of funds involved in large infrastructure projects make important for project sponsors to establish and adhere to the following principles in structuring the project:

- * identify the key risks,
- * evaluate the level of acceptability of each risk,
- * allocate the risks to different parties involved.

In the first instance, the objective must be to minimize the risks associated with the physical part of the project, with adequate geological, technical, market etc. studies. Thereafter the process is one of insuring, controlling and apportioning risks according to the parties' willingness and ability to bear them. Although one may argue that little, however not insignificant, can be done to alter the underlying risk of a project, allocation of the various types of risk to those participants best able to handle them does reduce a project's overall riskiness. Risks are often allocated using a matrix of various risk components and project participants, the same matrix that is then used by the financial advisor to aid in legal discussions and contractual arrangements (Table 5.1).

Each project phase - Development, Construction, Operation - is characterized by distinct financial considerations, sets of participants, and associated risks.

* Development Phase

The development phase is usually long, since at this stage the structure of the project financing deal is being negotiated and the required technical and environmental details are being specified. These negotiations may prove to be very time consuming and it is at

Project Risk Summary

Project Phase/Risk:	Allocated to Participant:
<u>Development Phase</u>	
Technology risk	sponsors
Credit risk	banks, developers, sponsors
Bid risk	sponsors, financial advisors
<u>Construction Phase</u>	
Completion risk	contractors, sponsors, suppliers
Cost Overrun risk	sponsors, subcontractors
Performance risk	sponsors
Political risk	sponsors
<u>Operating Phase:</u>	
Performance risk	O & M contractor
Cost Overrun risk	sponsors
Liability risk	national and local governments, insurance companies
Off-Take risk	sponsors (consumers)

TABLE 5.1 : REPRESENTATIVE RISK ALLOCATION MATRIX

this stage that the role of the financial and technical consultants is very critical; it becomes clear that they have to be well acquainted with the local regulations and available human resources. At this stage, funding is in fact venture capital, and thus it is hard to acquire money from commercial or investment banks. Governments, private developers and contractors, usually in consortium, take an equity position in order to attract additional funds.

The risks associated with this phase and contractual arrangements which can help allocate each risk component to the appropriate participant and arrange the many guarantees and undertakings necessary to cover each component of risk include the following:

**** Technology Risk**

The technology risk connects the technology design standards of the project at the time the project was initially conceived, with the equivalent standards at the time the construction is about to start. It is essential to consider the possibility that a proposed innovative technology may not prove economically or structurally viable, or regulations regarding its use may change. Infrastructure projects are normally sensitive to public opinion, therefore regulations acceptable for private projects may prove too innovative for a public project (i.e. environmental issues, safety issues). Project sponsors assume at least part of this risk through their equity participation. It is stated by engineering consultants that unless the owner assumes part of the technology risk, the consultants will very rarely attempt an innovation whose risk they will bear alone.

**** Credit Risk**

The project requires an initial amount invested on it, which is normally high and critical for the success of the project. The credit risk has to do with the creditworthiness of an individual - or group - sponsor, and the project as a whole. Credit is often enhanced through letters of credit required by potential lenders and issued on behalf of developers

by small or medium-sized merchant or commercial banks. By allocating credit risk away from the sponsor, these credit enhancements ensure that the lenders need not rely solely on an individual - or group - sponsor's creditworthiness. In other situations, rating agencies rate projects based on the credit strength of the sponsoring consortium, and implicitly define through their tested method the corresponding cost of capital. For Greece and other EC countries, the European Investment Bank usually plays the role of the guarantor in cases where a government or "government-backed" consortium is the developer; this is usually the case for large infrastructure projects.

**** Bid Risk**

However rational and precise methods are used during the initial selection of the most suitable bidding procedure for a project, and during the consecutive selection of the bid winner, all projects involve the risk of not being launched successfully. This risk is assumed by project sponsors who may retain equity until the facility is up and running because this may give them a negotiating advantage in future deals, and by financial advisors who are usually willing to provide their services on a success fee basis, thus undertaking some of the risk that the project is not going to work successfully.

*** Construction Phase**

The construction phase is crucial for the economic viability of the project because high uncertainties exist which may cause unprogrammed delays in the project completion. A prolonged construction phase will delay the revenue flow and hence will threaten to jeopardize the repayment schedule. Risks identified and solutions proposed during the construction phase include the following:

**** Completion risk**

The probability that the contractors will prove unable to complete a project within the time span originally planned defines the project's completion risk. The completion delays

can range from as short a time as a month to long enough to consider the project abandoned. The trend in project finance is to assign the risk that the project may never reach the operating stage to the engineering and construction (E&C) contractors. The contractors, in turn, allocate segments of completion risk to equipment and resources suppliers. Project sponsors prefer arranging contracts with turnkey contractors who use proven technology, and who agree on a specific time schedule, in which they assume responsibility for completion of the entire project. However, these are difficult to obtain and are normally result of negotiations. Typically, contractors do give some form of guarantees that specify a time frame and a rate of minimum operating efficiency, such as performance bonds, advance payment guarantees/bonds, and retention money guarantees/bonds. These guarantees do not normally expire when construction is finished, but remain active for an additional period sufficient to ensure that the project can perform as designed. In some cases, performance incentives, such as extra bonus for construction management and labor, are used if the project is completed before schedule.

**** Cost Overrun risk**

Cost Overrun risk is a financing risk which refers to the probability that the construction costs exceed the original estimates, and may be caused by a great variety of factors, such as unexpected inflation, material shortages, contractor's bad performance. Any cost overrun must ultimately be borne by the sponsor or contractor, but it may be funded by lenders or by precommitted cost overrun (contingency) financing. The major danger that cost overrun creates in a project finance deal is that it endangers the ability of the expected project revenues to cover operating costs and debts, since the assumed - budgeted - project cost is one of the major variables of the project's financial feasibility. The financial advisors usually propose ways to allocate this kind of risk from the very beginning of the project, which include:

1. additional capital by project sponsors, planned to cover all kind of contingencies.
Although it is unusual for a project to obtain unlimited funds to cover all possible

contingencies, a well-planned project will make "adequate" provision. The exact amount provisioned depends on the duration and the implicit cost uncertainties of the project.

2. standby credit facility from original lenders, which however, although it solves the cash flow problem it raises the cost of the project.
3. fixed price contracts from contractors, thereby allocating the risk to them. In such a deal the contractor always includes a higher fee for the risk he takes. This implicitly increases the overall project budget. The advantage is that the sponsors can count on a precise budget, and the disadvantage is that the contractors require 100% complete plans and design, in order to offer a fixed price. Since large projects are usually not completely definable and capable of being cost out, such deals continue including high inherent uncertainties.

**** Sponsor's Performance risk**

The sponsor of the project has the overall responsibility to make sure that the project satisfies the required standards, and that contractors are properly compensated for their services. The case becomes more interesting in the case where the sponsor and the owner are not the same "person"; this is the case with government/owner and private sponsors. A sponsor may not meet quality standards or deadlines by failing to provide goods and services of specified quality standards on schedule. Completion and performance guarantees are used to cover this risk.

**** Political risk**

The political risk is considered by many financial advisors as the most critical factor in structuring the project finance deal, as it influences all the other project risks. Political risk includes a great variety of problem sources, such as legislative or regulatory changes (particularly tax laws and environmental regulations), the possibility that the government will disallow repatriation of funds, labor unrest and strikes, embargo of construction

equipment, or even outright expropriation. Political risk is especially associated with large infrastructure projects, and because it is so difficult to control and consequently allocate, one can see why many private sector successful developers avoid infrastructure projects unless they get the government guarantees that their financial advisors demand. Strong political backing from both government and opposition parties and a pressing public need to be present in order to attract private developers. There are some measures that are normally undertaken in order to mitigate the impact of the political risk, which include:

1. domestic political risk may be mitigated if the relevant political body (government) commitment and strong desire for the project realization by providing tax-exempt financing.
2. form a consortium with experienced partners and international investors so that a negative political impact on the viability of the project will result in default of a number of international loans and jeopardize the country's credit rating to an unacceptable degree.
3. organizations like the US's Overseas Private Investment Corporation (OPIC) and the UK's Export Credits Guarantee Department (ECGD) provide insurance to alleviate foreign political risk.
4. participation of the host government and major local banks and organizations in the financial responsibilities of the project in the case that an unexpected event occurs.
5. for the specific case of Greece, guarantees supported by EC financial institutions offer a high-quality insurance for investors due to the Greek government's high dependency on the EC financial support.

* Operation Phase

When the construction phase is completed successfully, a part of the project characterized by great uncertainties is over and thus the financing terms for the debt portion of the capital can normally be more favorably negotiated. The project starts providing revenues,

which should fulfil two tasks: first, they have to start repaying the debt, and second, they have to provide adequate funds for the operation and maintenance of the project. Although at this point a significant part of the involved risks and uncertainties have been resolved, since the project is now operational, certain risks are still present:

**** Cost Overrun risk**

The human resources and raw materials required for the operation of the facility include a high uncertainty, as far as their price is concerned, because the development phase, when the estimate of their price has to be done, and the operation phase, when their price is actually paid, have a significant time lag. The uncertainty becomes higher for long infrastructure projects in countries like Greece due to relatively high inflation and high exchange risk. In order to decrease the risk exposure, contractual agreements, such as price escalations and pre-agreements on materials prices, are included in the Project structure negotiations.

**** Performance risk**

Operations and maintenance contractors may not meet the quality standards that had been demanded and agreed on during the arrangement of the project finance deal. Efficient management and operation are clearly of great importance to the sponsors, the financiers, and the owner. In many cases the sponsors themselves will provide the necessary levels of expertise. Lenders will usually require firm management contracts between the sponsors and the contractors. An efficient management team is required to control the performance of the contractors and mitigate the performance risk. One effective combination for infrastructure projects would be to include in the management team private consultants with expertise in the particular operation area and representatives of the equivalent local public company. In this way the government/owner may ensure that the management team will be interested in the quality level of the offered services. At the same time the local public company will have the opportunity to acquire technical and

management skills from the cooperation with the private consultants during the repayment period. Performance risk is allocated to the contractors. It is essential that the sponsors negotiate the operation contracts not long before the end of the construction phase. The closer the delivery time, the more the uncertainties that will be eliminated (i.e. actual delivery time, operating site characteristics), and the less the risks that the operating contractor will have to bear and include into his expected return and price offer.

**** Liability risk**

Liability risk involves the risk that any person may die or get injured in the operating facility. The first step to allocate this risk is to define the required safety measures and standards clearly and precisely in the initial agreement. As long as the contractor operates the facility according to these standards, the liability risk can be allocated to the local or national government involved. Additionally, private insurance companies can cover part of the risk and make suggestions for the improvement of the safety system.

**** Off-take risks**

One of the main concerns during the structure of a project finance deal, is the estimate of the expected project revenues. Lenders want to make sure that the sale of the product or service generated by the project can provide sufficient revenues to pay their loans. Infrastructure projects are often hard to provide this level of security of cash flow, and the off-take risk that the project may not meet revenue projections is high. In bibliography the off-take risk is referred to as the toll revenue risk in transportation projects, the resale price risk in industrial projects, the resource risk in mining and oil development projects, and generally the overall economic risk of the project. Banks and lenders together with the financial advisors of the sponsors should carefully examine the different market and political scenarios that may affect the expected project revenues and make their judgement on whether the expected returns are sufficient for the risk they bear and the security they are offered. For infrastructure projects the host government can guarantee a minimum

operation income for a predefined period through off-take agreements. These agreements may take any of the following two structures: a) take-or-pay agreement, which guarantees a particular payment level whether or not the product or service is purchased, and b) take-and-pay agreement, which guarantees that the product or service will be purchased and paid for. The government through such agreements, which serve as the project's fundamental credit support to lenders, tries to attract lenders and private sector sponsors by offering extended security; loan repayment will be provided even in case of severe fluctuations in market demands or other "force majeure".

Remark: A well running operating phase offers the opportunity to the project sponsors, to negotiate with their lenders and investors the terms and/or schedule of the remaining debt repayments. At this time the sponsors have a more accurate image of the actual project market size and expected cash-flows. Therefore they are in place to negotiate a new loan which will provide them inflows for the repayment of the initial loan, and whose repayment schedule will be evenly spread in the project economic life and better customized to the specific project's cash-flow.

5.1.3 Overall project financial risks

In large infrastructure projects serious financial exposure risks are present throughout the project finance process and must be continuously monitored. The financial advisor of the host government together with the project sponsor and his advisors attempt through financial engineering mechanisms to allocate the financial risks to those who can best bear them so that decrease the overall project risk. They attempt to match the maturities and currencies of the cash-flow needs with the needs and interests of the project investors and participants.

Two are the main risks with the above characteristics which are typically faced through

financial engineering mechanisms:

- ** Interest Rate Risk: Part of the role of the financial advisors is to design the expected cash flow model and decrease the exposure of the cash flow inputs in interest rate changes. For long maturities the method used extensively during the last decade is the swap method. This is an exchange of one coupon or interest payment for another that has a different configuration but the same principal amount. For shorter maturities, the traditional methods of treasury notes, and option and future contracts can cover effectively the interest rate exposure.
- ** Foreign Exchange Exposure Risk: The large infrastructure projects are capital intensive. Therefore in countries like Greece where the financial markets are not mature and large enough to raise all the required capital, they are highly sensitive in foreign exchange rate fluctuations as revenues and/or expenses are paid out, at least partially, in foreign currency. To mitigate the exposure in this risk, financial advisors can use similar techniques and mechanisms as in the interest rate risk. In short term transactions, foreign exchange exposure can be hedged by using forward option or future contracts. For recurring transactions such as the ones involved in the operating and maintenance revenues and expenses, the foreign exchange exposure lasts for a longer period for which appropriate hedging mechanisms are coupon swaps or long-date forward option and future currency contracts. In the case of contractual items, i.e. those fixed in nominal terms, this simply involves matching net positive positions in each currency with borrowings of similar maturity. The goal is to offset unanticipated changes in home currency value cash-flows with identical changes in the home currency cost of servicing its liabilities. With non-contractual cash-flows the same principle applies.

The current economic situation in Greece, which is characterized by:

- huge national budget deficits,
- the highest inflation rate in EC,

- domestic and international recession, and
 - the international financial markets constraints in raising cheap funds,
- in conjunction with:
- the high needs in infrastructure projects crucial for the economic recovery and development¹⁹,
 - the decreased credibility of the government in international financial markets, and
 - the high immediate capital needs for projects that have already been announced,
- make it necessary to consider the above principles during the structuring and organization phase of the these projects. They need to be financially feasible, and eligible for the adoption of project finance principles. The Greek economy can no longer afford the high capital expenditures connected with the construction, operation and maintenance of non-feasible projects, which require periodical government financial support. High priority projects can be promoted by providing initial grants for them which will be supplemented with funds raised by the "project finance" approach.

5.2 User Fees

The term User Fee is used broadly to include any fee, charge, or dedicated tax that is paid by those benefiting from a facility or the services it provides.

The purpose of a system of user fees is to recapture sufficient benefits that accrue to users and other beneficiaries of public projects and services to cover both capital and operating costs in a way that promotes efficiency in use and production. However, projects that also serve broad public purposes may still require some subsidy from general revenues to

¹⁹ The Greek government plans to spend some \$7 billion on six major projects, according to the estimates of Manufacturers Hanover which served as project finance advisor of the government for the initial evaluation phases of the projects.

account for the public benefits.

Determining the true cost of a service or facility is fundamental to the establishment of a user fee system. The first in determining the true cost is to identify its cost components, which may be broadly divided into:

1. Direct Costs: are those that can be specifically assigned to providing a particular service. They include operating and maintenance costs (i.e. employees wages and benefits, materials, supplies), and capital costs (i.e. interest charges on long term debt issued to finance the construction phase).
2. Indirect Costs: are those necessary for the delivery of the service but not easily assignable to that service. Infrastructure related services may include a share of the cost of centralized government -or corporation- functions such as data processing and depreciation of buildings. The recognition of these indirect costs is essential for an accurate determination of the full cost of an infrastructure service. However, their allocation is usually a practical problem where government and municipality agencies providing services for infrastructure facilities have not developed procedures for costing those services. In Greece, this has become a major problem through the years; government's -and municipalities'- overhead expenditures keep on increasing as new infrastructure facilities are added to the government's -or municipalities's- "portfolio", and no formal procedures exist to allocate part of these costs to those who really benefit.

A useful conceptual framework for the setting of user charges is to classify them as either Fixed Costs or Variable Costs:

1. Fixed Costs: or commonly called "overhead" costs, are those that do not change in response to increases or decreases in the production of a service. Fixed costs include: rent, debt service, contract commitments, pension benefits.
2. Variable Costs: are those that increase or decrease in response to increases or

decreases in service levels. Typical variable costs include: wages, fuel, materials, and supplies.

User fees can be effectively applied in cases where:

- the provided service can be considered primarily beneficiary for a distinguishable group of users, and only vaguely for the society as a whole,
- the demand of the provided service should be controlled and kept to logical levels in order either to decrease waste or to preserve a natural resource,
- the allocation and collection of user fees are feasible without comparably very high cost. This implies that it is possible to define a clear two-way relationship between producer and consumer.

The user fees, if properly designed, offer the following advantages:

- they urge, or force, consumers use cautiously the service offered. When charges based on wastewater volume and quantity of pollutants are initiated, it may become more economical for an industry to improve equipment, change processes, or alter housekeeping procedures so that less material enters the wastewater or less water is used. The material formerly lost to the wastewater systems may be either retained in the process or handled as a solid or kept as concentrated waste and not sewerred. For example, direct condensing or cooling systems may be converted to recirculated systems. The service charge may make recovery processes economical so as to retain valuable material or yield a by-product formerly discharged.
- they help the producer estimate the "real" size of consumer needs/demand and decide the expansion, restriction, or conservation of the size of the offered service.
- as revenues will be generated by a clearly defined source, it will be more difficult for municipal or government officials to allocate them to services irrelevant to the specific service, compared to general tax methods.
- the claim has been made that a user fee system permits fair charges to churches,

tax exempt schools, organizations and other governmental units that ordinarily do not pay property and income taxes.

Three sewerage- and wastewater treatment-related user fees models are identified to be used to set proportionate rates:

1. the Volume-based Model which is essentially a flat model. The model is based on the philosophy of charging all users (household, commercial, and industrial) a basic rate determined on a volume basis. This basic volume is assumed to have a normal concentration of Suspended Solids (SS) and Biochemical Oxygen Demand (BOD)²⁰. Such a model necessitates a means for measuring or estimating discharge rates. The most practicable means of estimating wastewater volumes is to use the customer's water-use records provided by the water-meter. Estimates of average figure can be used for unmetered situations. An allowance can be made for water not entering the sanitary sewer (i.e. garden watering, swimming pools). This may be a fixed percentage reduction of water use, or a second meter for the non-sewered water.
2. the Surcharge Model which is also a flat model. It requires the establishment of two rates: a volume rate for all users and a surcharge for users whose discharge strength materially exceeds that of the base rate users. The measurement of the characteristics of wastewater usually used for such charges are SS and BOD.
3. the Quantity/Quality Model is a essentially a variable user fee system that requires the establishment of separate unit rates for volume and strength. It levies a user fee based on the quantity and quality of discharges from each user or class of users. This requires monitoring and measurement of effluent. Because of the higher

²⁰ Strength is typically evaluated on the basis of "suspended solids" -solids that either float on the surface or are suspended in water or wastewater and are recoverable by a filtering process- and "biological oxygen demand" or BOT -a measure of the amount of biodegradable organic material present.

relative costs of implementing quality/quantity systems, such systems are typically employed only where sewerage discharges vary significantly in volume and strength, such as where major industries contribute to the wastewater flow.

In Table 5.2 different schemes of user charges estimate that are to reflect the actual physical use of a wastewater and sewerage system, in some degree, are summarized.

When demand exceeds capacity and does not vary significantly over time the government or municipality should consider the expansion of the sewerage network and the wastewater treatment facility. The real problem exists if demand does vary over time and exceeds capacity only during certain peak periods. This is a major problem for the small coastal municipalities in Greece, where their summer population may be double or triple compared to their winter population. In this case a Peak Load Pricing Model may be implemented to allocate capacity and recover the greater peak-load marginal costs. A simple peak-load pricing structure may consist of two levels of charges. Off-peak charges, implemented during the "low population period" would be designed to recover only operating and maintenance costs; peak charges, implemented during the "high population period" would be designed to recover a capacity cost as well.

The suggestions of applying user fees to sewerage and wastewater facilities, and in general to public facilities and services, is often strongly opposed. Five of the most common arguments are:

1. the construction and operation of a wastewater treatment facility bring widespread social benefits for which a price cannot be charged. In the case of a summer resort which attracts a lot of foreign tourists, the argument would say that the foreign exchange that they bring in Greece provide benefits to the Greek economy as a whole.
2. infrastructure projects with a strong social good character, such as wastewater

SCHEMES OF USER CHARGES ESTIMATE FOR WASTEWATER TREATMENT SERVICES

Wastewater service charges provide for financial support of sewerage and wastewater treatment facilities based on some scheme that reflects the actual physical use of the system in some degree, such as:

1. Volume of wastewater
2. Volume of wastewater plus quantity of polluted matter, such as measured BOD, SS, chlorine demand, phosphorus, and nitrogen
3. Number or size of sewerage connections
4. Type of property, such as residential, commercial, or manufacturing
5. Number and type of plumbing fixtures, water-using devices, or rooms
6. Uniform rates per connection
7. Percent of water charge

TABLE 5.2 : DIFFERENT SCHEMES OF USER CHARGES ESTIMATE FOR WASTEWATER TREATMENT SERVICES

SOURCE: APWA, ASCE, AND WPCF, 1973

treatment facilities which contribute to the public health, should be redistributive -that is, they should be provided for those with low incomes who could not otherwise enjoy them- and therefore should be paid by the entire society. In the case of sewerage and wastewater treatment the argument becomes strange since consumers normally do not have a choice.

3. infrastructure projects are required to attract development and therefore should be subsidized from general tax revenues. The fiscal surplus from the ensuing development, it is argued, will pay for the projects in the long run. In EC, where investors consider environmental protection projects as one of their primary selection criteria when they consider investing in a foreign country, and where investment incentives are highly correlated with the existence of environmental protection, this argument becomes highly critical in the case a country like Greece intends to attract foreign investors.
4. dedicating tax revenues for specific purposes reduces the flexibility of the budget-making process to deal with rapidly changing public priorities and needs. Additionally, dedicated revenues and separate administration of different projects prevent a coordinated approach to public development. This argument opposes private sector initiatives and stands for a centrally planned development model.
5. user fees many times do not provide for payment by undeveloped property or for the benefit of having sewer and treatment capacity available whether used or not, which raises the property value. The imposition of Impact Fees may be argued that attempts to adjust for this misbalance, as well as for the presumed added burden that new development have on infrastructure services demand. Impact Fees are a dollar-based fee requirement that every new development has to pay to the "producer" of certain infrastructure services.

One of the key problems of sewerage and wastewater treatment corporations in Greece, is the collection of the user fees; this is translated to what measures are socially, politically and legally allowed to be taken in order to enforce consumers to pay the

service charges they owe. The method provided for enforcing payment of service charges becomes of primary importance when project finance approach and private sector involvement are considered, since the sanctions available will be taken into account when setting discount rates and creating cash-flow models. Methods for assuring collection include: (a) deposits, (b) payment in advance, (c) making the owner of the premises liable, (d) shutting off service, (e) liens on premises. Some basic remarks that can be made for the available methods are:

1. water and wastewater charge interrelationship: although fundamentally independent, wastewater service charges are often closely related to water service charges, either by combined billing or by using the water charge or the water quantity as the basis for the wastewater charge. Even in cases where the two charges are not collected together because the two facilities are not under single ownership, it is highly recommended that this be permitted as a matter of voluntary contract. Although shutting-off waste water service could be physically difficult, shutting-off the water to collect wastewater charges could be a more practical method. However, health and sanitation problems are presented, which have to be seriously considered and which may make shut-off impractical or unenforceable.
2. provision of a statutory lien is common to utilities of local unities of government in USA. Whether or not the premises are subject to a lien, and the nature and priority of the lien depend entirely on the law provisions. In some states in USA such liens have the quality and priority of a mortgage lien, whereas in other states, delinquent charges may be enforced by having them entered on the tax duplicate and then collected in the manner of ad valorem taxes.
3. in addition to the sanctions, certain devices are available that act as inducements: discounts for prompt payment, payment of interest for delinquent accounts, and penalties. As far as discounts are concerned, it is suggested that they should be related in amount to the cost they are designed to obviate, that is, interest,

accounting, and follow-up attempts to collect overdue bills. The leverage of the discount device is increased if interest or penalties or both may be exacted on overdue charges. However, legislative or administrative regulations may be required for the impose of penalties and/or interest on overdue accounts.

5.3 Bond Financing

The issue of Bonds is a very common Government financing option. There are two options for a bond issue aiming the financing of an infrastructure project; the bond can carry either the full faith and credit pledge of the issuing government or it can carry the security of the revenue generated by the project being financed. The first case is called General-Obligation-Bond and the second one is called Limited-Obligation-Bond or Revenue-Bond.

The main difference between Greece and U.S.A., where bond financing is very popular for infrastructure projects, is that in Greece credible public authority is only the government and not the local municipality authorities. Even worse, the bond market is not large enough to afford the financing of both the common government accounting needs and the infrastructure projects.

5.3.1 General Obligation Bonds (G.O.B.)

The General-Obligation-Bond (G.O.) is probably the best-known type of public financing instrument. It is the one best understood by the issuing and by the investment communities. A G.O. bond carries the full faith and credit pledge of the issuing government, which assures that the taxing authority backs the loans. The only real risk that investors have to consider is that the government declares bankruptcy. The interest

that an investor earns on G.O. is tax exempt and, because of the instrument's wide acceptability, the interest generally is lower than other types of tax-exempt debt. Due to their long-term character and to the unsteady economic environment in Greece, the interest rate is usually floating.

The great disadvantage of the G.O. bond, as far as infrastructure financing is concerned, is the risk that the government may use the bond funds for other accounting needs.

The Greek Government in order to raise the funding required for a specific project, the "Attiki Road", plans to issue a G.O. bond, under the name of "Attiki Road Bond". Typical issuer and fund manager of this bond issue is going to be a public company called Special Account for Urban Planning. The incentive for the investors is going to be a 0.5% higher interest than the normal G.O. . Further details for this specific issue exist in paragraph 7.1.3.1 . In Table 5.3 the basic characteristics of a G.O. bond are described.

5.3.2 Limited Obligation Bonds

Another traditional method of bond financing is the Limited Obligation or Revenue bond (L.O.) . Unlike the G.O., the security behind revenue bonds is the revenue generated by the project being financed and none of the taxing authority of the issuing government is involved. Because of this, in evaluating a revenue bond alternative, it is necessary to determine that future revenues will be sufficient to support future debt service. Since the revenues are not backed by taxing power, L.O. bonds are thought to be riskier than G.O.s and tend to carry higher tax-exempt interest rates.

Unlike most G.O.s, L.O. bonds most often carry reserve requirements that serve to protect the investor in the event project revenues are inadequate to meet debt service requirements. The size of such reserve funds varies, but it is not unusual for reserve funds

BOND FINANCING OPTIONS

Features:

Definition/Purpose:

G.O.B.: used to finance projects of broad community interest secured by full faith and credit of issuer (present and future tax revenues)

L.O.B.: long-term financing secured by revenues generated by project being financed, no taxes revenues pledged as security

Type of Interest:

G.O.B.: tax - exempt, normally floating in Greece

L.O.B.: tax - exempt normally floating in Greece

Term:

G.O.B.: 15 - 20 years

L.O.B.: 15 - 30 years

Reserve Fund Requirements:

G.O.B.: not required

L.O.B.: required to hold money to pay debt service in event of temporary revenue shortage

Advantages:

G.O.B.: well-known financing option, widely accepted by investment community hence usually sold at lowest tax-exempt rates.

L.O.B.: user pays for facility, frequently not subject to debt ceiling

Disadvantages:

G.O.B.: legal and underwriting expenses may be high, may be subject to debt ceiling, it may be used by the government for issues not related to the project

L.O.B.: higher interest costs because they are totally dependent on project revenues, legal and underwriting costs may be high

TABLE 5.3 : BOND FINANCING OPTIONS UNDER PUBLIC OWNERSHIP

SOURCE: WEISS, 1985

to equal one year's debt service requirement. A reserve fund has two results:

- it requires the issuing government to raise funds in excess of the amount needed to finance the project, and
- such excess funds can be invested on behalf of the issuing entity with the earnings offsetting part of the interest being paid on their debt.

Among the advantages of the revenue bonds is the fact that the users, rather than all taxpayers, pay for the facility. However, the proper mix of Grants, or G.O.bonds, and L.O. bonds can help satisfy the theory that the benefits of an infrastructure project should be reflected both to the immediate users, who must pay the greatest part of the project cost, and to the general public, who should participate to the project cost through tax revenues (Externalities). In the case of an L.O. bond the public participation to the cost of capital comes implicitly through the tax-exempt interest rate. The disadvantages of L.O. bonds include the perceived higher interest that an issuer will pay, and the consequent higher user fees that will be required. Due to their long-term character and to the unsteady economic environment in Greece, the interest rate is usually floating. In the Table 5.3 the basic characteristics of a L.O. bond are described.

5.4 Privatization - Private sector involvement under alternative contractual structures

The growing dissatisfaction in many countries with the performance of the public sector in delivering goods and services has focused attention on ways to improve the quality of service delivery by the public sector. The expansion of the public sector has stretched, in many cases, managerial capacity to the point where serious inefficiencies result. Time and bureaucratic failures have proved to be extremely costly, and prevalent; for example, low-yielding public investments and inefficient public enterprises have slowed growth and

contributed to expanding public debt; neglect of maintenance has led to a rapid deterioration of public assets; excessive and poorly designed and implemented regulations have contributed to growth in the underground economy.

As a consequence, there has been reexamination of the role of the state and a growing awareness of the need to reassess priorities, prune what has become unmanageable, and use all resources, including managerial and business experience of the private sector, more effectively and efficiently for the public benefit. The emphasis has shifted toward tapping private skills and resources wherever possible and strengthening the state's core responsibilities, such as providing adequate social and economic infrastructure and a supportive policy and regulatory environment. *"The social responsibility of business is to tame the dragon, that is, to turn a social problem into an economic opportunity and economic benefit, into productive capacity, into human competence, into well-paid jobs and into wealth"*, so wrote Peter Drucker, noting that governments now have neither the management capabilities nor the resources to carry out all the burgeoning tasks that citizens claim from them.

According to two of the most representative definitions which exist in the literature, one from a consulting firm and one from a government agency, **Privatization** :

1. "... is a process through which local governments can capitalize on advantages unique to the private sector in owning, building and/or operating capital-intensive facilities. These advantages may be significant when compared to facilities funded, built and operated by the public sector."
(Goldman,H., and Mokuvos,S., "The Privatization Book", Arthur Young International, 1984)
2. "... refers to a public/private partnership concerning any mutually beneficial activity undertaken by government and business to solve community problems that yield benefits to both the private interest and community at large. In other words,

this partnership involves a systematic process in which both parties identify a mutual problem and subsequently negotiate a joint approach to solving the problem."

(Weiss,B., "Public/Private Partnerships: Financing a common wealth", Government Finance Research Center, 1984)

The literature on privatization separates politics and administration; "doing" and "deciding" are seen as different functions. *"In true privatization, the government's role is only reduced; it does not disappear. And what is relinquished may be the easiest part of the whole job -the doing. The conceiving, planning, goal-setting, standard-setting, performance monitoring, evaluating, and correcting all remain with the government. If these are done badly, the public interest suffers, and so, usually, does the contractor. This is why privatization is not panacea for governmental incompetence"* [Sundquist, 1984].

Therefore there is no a priori reason to believe that privatization of government projects, services or other arrangements in which third parties are used will result in more efficient, effective, and economic delivery. Then why the is the privatization approach being used more and more, both in high-income economies such as U.S.A. and U.K., and in developing countries with the support of World Bank ? Over the last 10 to 15 years there has been a confluence of several "big picture" trends that have led to privatization:

1. there is an increasing need to rehabilitate, replace, or build new public facilities to meet the population growth. Yet at the same time, there is a decreasing amount of government funds available to finance these facilities and infrastructure, and a decreasing tolerance among taxpayers to increase taxes.
2. there is an increasing realization on the part of many governments worldwide that they should not own and/or operate certain types of facilities and infrastructure.
3. the overall cost of private finance for privation of infrastructure projects is decreasing, to a point where it may have become competitive with the overall cost of public finance. Especially, in cases where a public/private partnership is

implemented allowing the use of government financial backing and sources, the cost gets very low.

4. the number of successful privatization projects is increasing. This raises the confidence of the public and private sectors in using the approach.
5. new environmental regulations, new technologies, and new standards have emerged, which have increased the project required expertise and qualification, and the construction and operating costs.

The relationship between the private and public sectors must be viewed in more than zero-sum terms. The private sector's gain need not be thought of as a loss to the public sector or vice versa. The prosperity of the two is inextricably linked. In practice, the Partnership may take any weighted contractual form, from partial private sector participation to 100% private financing, construction, operation and ownership (Table 5.4). Whatever the exact structure, the characteristics and elements of a successful partnership include:

1. ultimate users of the service provided by the facility should experience lower service charges than if the service was realized through conventional public financing approaches. It is assumed that the user charges would be calculated at least at a break-even point with the real capital costs of the project.
2. most privatization transactions will not be regulated by the bureaucratic public utility commission; rather, safeguards to protect the public interest and guarantee performance standards will be established through other vehicles, included in the contractual agreement.
3. all parties to the transaction must understand the risks involved, and take collective steps to ensure that risks are properly managed and reduced, and taken on by the party best-suited to bear them.
4. interests of concerned local groups, such as existing employees, vendors, system users and others, should be carefully addressed.

DESIGN/ OPTIONS	CONSTRUCTION	OPERATION & MAINTENANCE		FINANCING			COMMENTS
		<30 YEARS	>30 YEARS	CONSTRUCTION	THEREAFTER	OWNERSHIP	
PUBLIC SECTOR SOLUTION	O	X	X	X	X	X O	SALE/LEASEBACK
FULL CONTRACTING OUT	O	O	O	X	X	X O	DIRECT LEASE CONTRACT SALE (PUBLIC TO PRIVATE)
PRIVATE FINANCE & CONSTRUCT	O	X	X	O	X	X	
CONSTRUCT, FINANCE & LEASE	O	X	X	O	O	X O	SALE (PRIVATE TO PUBLIC) LEVERAGED LEASE CONTRACT
PRIVATIZATION ON COMPLETION	O	O	O	X	O	X	
B.O.T.	O	O	X	O	O	X	
FULL PRIVATIZATION	O	O	O	O	O	O	

O: PRIVATE SECTOR

X: PUBLIC SECTOR

TABLE 5.4 : ALTERNATIVE CONTRACTUAL OPTIONS FOR AN INFRASTRUCTURE PROJECT

SOURCE: CLASS NOTES M.I.T COURSE 1.45 CONSTRUCTION FINANCE, FROM A SPEECH BY DR.B.PEHLSTEIN, ARTHUR D.LITTLE - 4/29/91

5. the private sector partner should earn a favorable return on the investment. On the other hand, there should be checks and balances in the contract to ensure the fiscal integrity of the project, including verification that adequate monies are available for facility construction according to the predefined standards, operation, preventive maintenance, eventual facility rehabilitation, and potential emergencies.

The successful implementation of the privatization approach is sensitive to several factors, including:

1. government tax subsidies are an essential incentive to induce private participation and implicitly support its realization.
2. there must be sufficient institutional and regulatory flexibility to allow negotiation and bargaining in working out the details of the privatization arrangement.
3. it is essential that the partnership takes advantage of the legal flexibility offered by the approach, and the knowledge and experience of both private and public sectors to use the most suitable for the specific project combination of available financing tools.

The privatization approach, as described in the previous paragraphs, offers the following advantages when implemented for sewerage and wastewater treatment projects:

1. provides the preconditions for a timely answer to environmental and economic development needs, reflecting the modern technology and quality standards. Moreover, whatever the tax subsidies incentives offered, privatizing a treatment facility creates a tax paying entity in the community.
2. relieves the municipal administrators of facility and personnel management, and operation and maintenance burdens, while not diminishing their control over service costs and quality. The private investor is a single point of responsibility that municipality authorities can turn to for assured service. The responsibility of the municipality authorities is to set and enforce service requirements; the

responsibility to meet them -manage the realization and operation of the project, deal with personnel matters, anticipate and resolve problems, interface with other interests- is the operator's. The operator and not the municipality will bear the risks of not meeting cost or performance standards.

3. decreases construction time delays related to bureaucratic procedures originating from compliance with central government procurement regulations.
4. permits greater flexibility in factors as sizing of treatment works and billing of users.
5. preserves local debt capacity for other essential purposes.
6. offers more predictability of costs to the municipalities because communities have a contractual commitment from their private sector partner in the transaction as to the service provision costs.
7. proper construction, operation and maintenance of facilities in many cases is best achieved through private sector contracting. Communities, being regulated by the general legal framework governing all public corporations, usually face difficulties which include the high pay scales necessary to attract and retain technical and well trained individuals, and restrictions to setting proper bonus rewards.

In the next four sections the four most common contractual privatization structures are discussed. Advantages and disadvantages are stated for each case.

5.4.1 Direct Lease

A synoptic description of the Direct Lease contractual structure can be found in Table 5.4, where the assignment of different categories of responsibilities between the private and the public sector is demonstrated.

In any variation of a Lease contract, two are the basic participants of the agreement:

1. The Lessee: Sometimes referred to as the user. The lessee collects and receives all income from the leased asset, makes the rental payments as predefined in the lease agreement, and of course receives any other optional benefits negotiated for.
2. The Lessor: May consist of one or more parties. Where there is more than one parties involved (not uncommon in major transactions), the lessors may be referred to as investors, equity holders, owner participants, or owner trustors.

Under the Direct Lease procedure, the lessee simply rents the properties and equipment from an established entity and pays a rent. For example, suppose that a municipality corporation constructs a wastewater treatment facility and consequently it leases it to a private sector corporation. The lease agreement allows the municipality exert service and quality control so as to protect the public interests. The payment normally contains the minimum payment plus a percentage of income generated from the project.

The advantages from the private operator's point of view are:

1. he enjoys the tax advantage because the lease payment is tax deductible, whereas only the interest is tax deductible in the case where a private operator is an owner of the facility.
2. he does not need to raise substantial funds, which would be necessary if he were the owner. The funds he needs for the lease payments, are spread throughout the lease period and generally match his revenues schedule.

The advantages from the municipality's point of view, are:

1. it avoids the risk of major fluctuation in the income or cash inflow. Under any financial scenario, the municipality has ensured to receive the periodical lease payments which are independent to the financial results of the facility. At the same time, it shares the benefits of a financial success of the project through the contracted percentage of the operator's income, without endangering the minimal

lease payments.

2. it avoids the operating and maintenance burden costs. Instead it exploits the private sector's experience and know-how which may render the project more feasible.

5.4.2 Leveraged Lease

A synoptic description of the Leveraged Lease contractual structure can be found in Table 5.4, where the assignment of different categories of responsibilities between the private and the public sector is demonstrated.

In the leveraged lease structure, presented in Diagram 5.1, the equity investment is provided by a passive, third party investor such as a bank, leasing company or financial institution. The financial institution (lessor) purchases the privatized facility through a combination of equity and debt. The structure is called a "leveraged" lease because debt capital makes up approximately 60% to 80% of the facility cost. The lessor takes the tax benefits of ownership and leases the facility to another private sector firm, the lessee. The lessee is the actual user of the facility and is the firm with the day-to-day operational responsibility and the direct contact with the community. In return for the use of the facility the lessee makes lease payments to the owner, who in turn, makes payments on the debt. The leveraged lease structure is in fact, a lease between two private sector firms, the owner and the operator. The operator enters, then, into a service contract with the municipality and receives service payments for provision of the sewerage and wastewater treatment service.

This structure is particularly valuable in the situation where the privatizing firm cannot make the most efficient use of all available tax benefits. Construction and engineering firms which are interested in privatization often have cyclical income patterns and

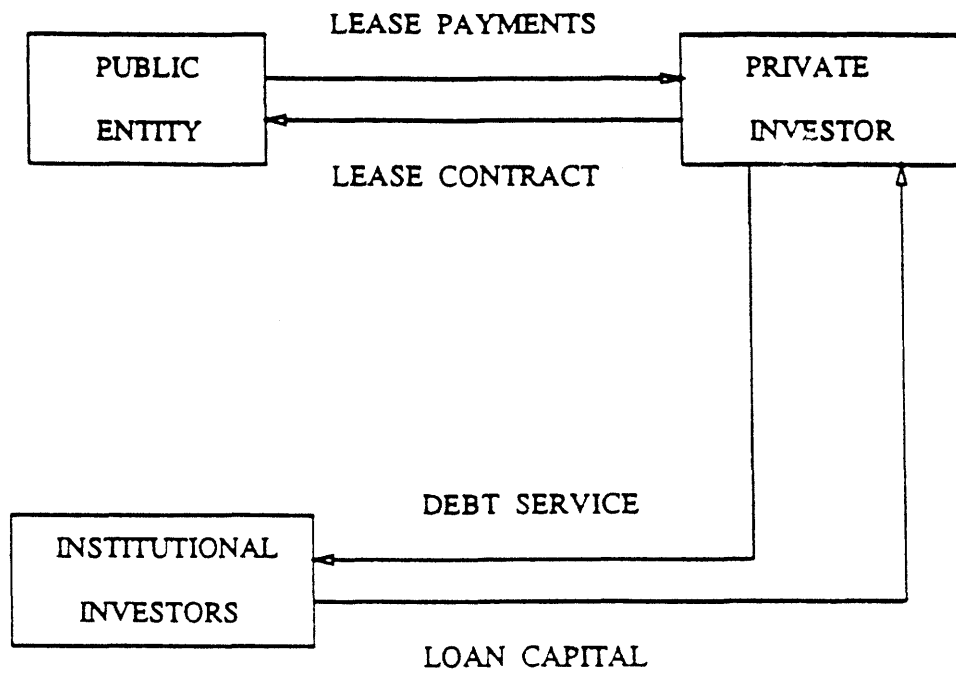


DIAGRAM 5.1 : LEVERAGED LEASE

SOURCE: PADDOCK, 1991, C

therefore cannot accurately predict their income tax liability. On the other hand, a leasing company or other major financial institution which is in the business of making this type of investment, and can predict more accurately its tax liabilities. Leveraged leasing transactions can be very complicated, therefore are best suited for large projects where the expected returns are sufficient to justify the high transaction costs.

5.4.3 Sale/Leaseback

A synoptic description of the Sale/Leaseback contractual structure can be found in Table 5.4, where the assignment of different categories of responsibilities between the private and the public sector is demonstrated.

The sale/leaseback option, presented in Diagram 5.2, is a method developed about 30 years ago to provide a mechanism to finance an aggressive expansion program, yet conserve the capital of the private company. It is basically a variation of the direct lease agreement. Under this transaction, the public purchases the completed project/ facility, sells them it to the private sector, and then leases it back. The level of lease payments depends on the owner's costs, including taxes, debt amortization, and investment premiums.

This structure is beneficial to both the public and the private parties. The municipality has the following advantages:

1. the high construction cost are balanced by the revenues generated by the sale of the completed project.
2. negative impacts to municipal indebtedness limits are avoided.
3. the municipality holds complete control of the quality standards of the sewerage and wastewater treatment plant and equipment, as it is the sole owner during the design and construction phases. At the same time, it holds complete control of the

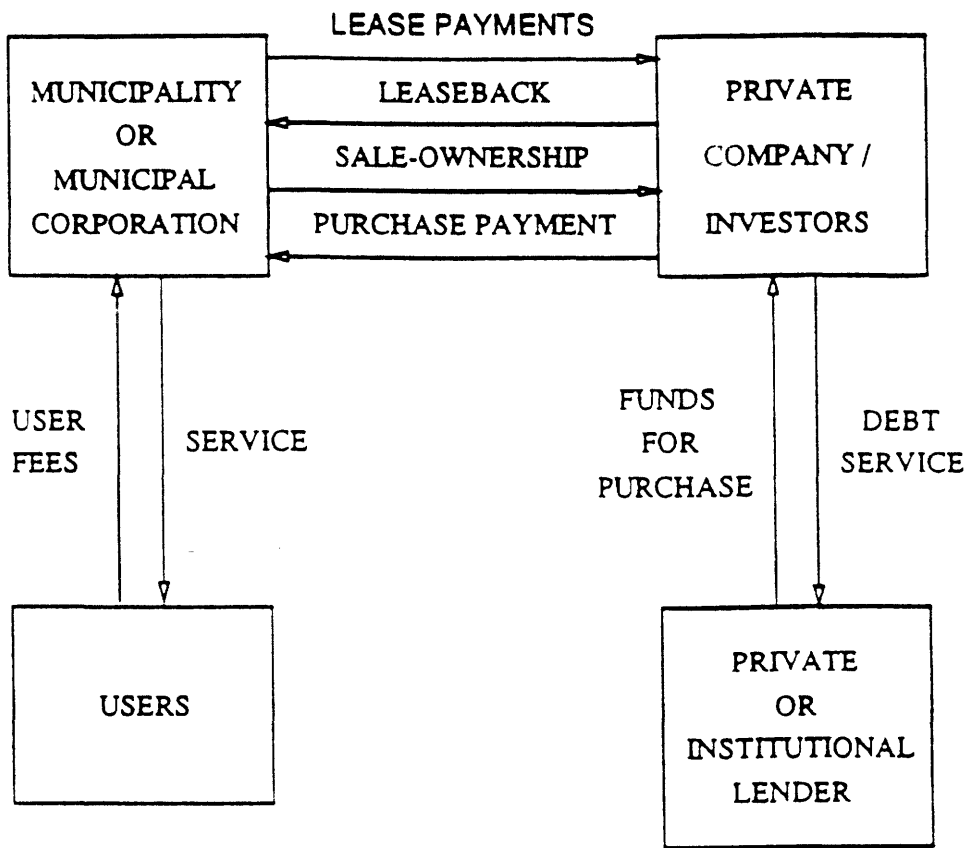


DIAGRAM 5.2 : SALE / LEASEBACK

SOURCE: PADDOCK, 1991, B

service quality, as it is the operator, without having to cover improvement and maintenance costs which are normally covered by the owner.

The advantages for the private entity are:

1. it receives a secure investment opportunity which normally yields safer returns than traditional real estate projects.
2. it takes advantage of depreciation tax shield as the owner of the facility.
3. it avoids the high and risky initial costs related to the construction phase. The investment it makes, though high in capital needs, immediately produces a revenue stream.

5.4.4 Build - Operate - Transfer (B.O.T.)

"Build - Operate - Transfer", or more generally concession-financing, can be defined as a major start-up business venture where private corporations undertake to build and operate a project, which would normally be undertaken by the government, and return the ownership to the government after a fixed concession period. The key participants in a BOT structure are presented in Diagram 5.3 .

Risks associated not only with completion, but with the underlying viability of the project will usually rest with the private corporation as a distinct entity, and not with the sponsors/ contractors or the government. That means banks, equity investors and creditors, who finance the corporation, must be satisfied that the project will be run efficiently, will attract enough customers, and will not run into technical difficulties. As they get their hands directly on the project cash-flow, they are expected to look to the revenues generated from the completed project as the main source of security for repaying the debts.

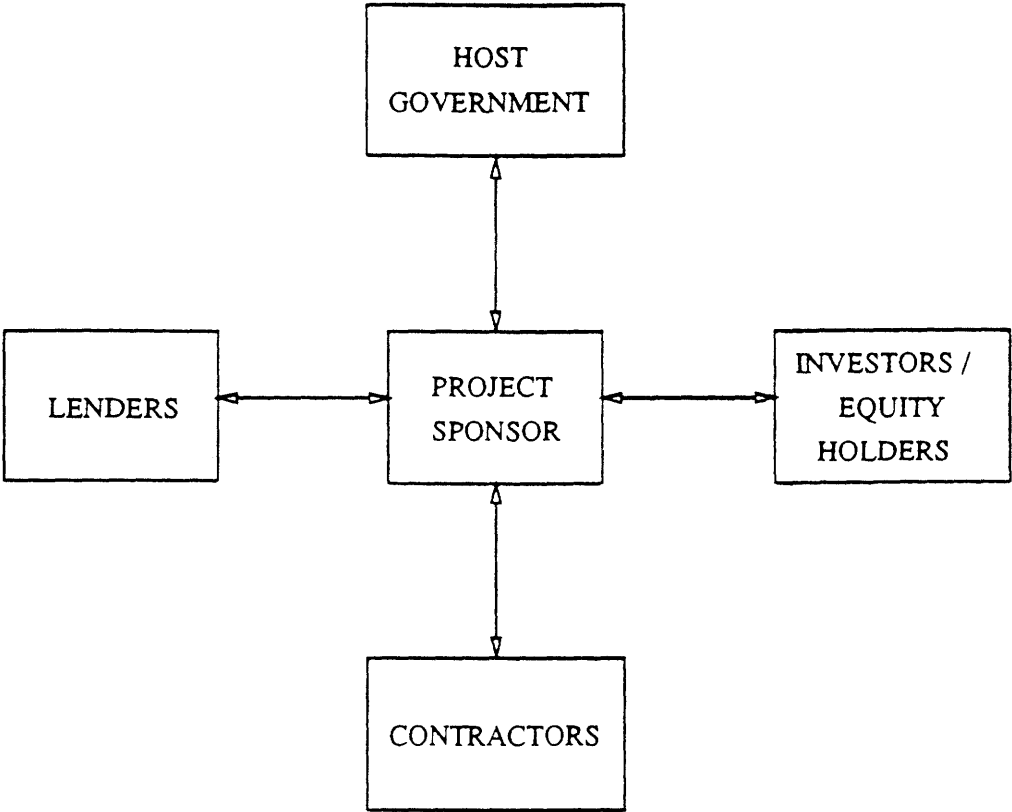


DIAGRAM 5.3 : MAIN PARTIES INVOLVED IN A BOT PROJECT

The analysis and allocation of risk is central to the effective structuring of a BOT project. Initially, the inherent risks of the project must be minimized through the appropriate technical and market studies. Consequently, risks must be analyzed, controlled and apportioned through a collective process and based on the willingness and ability of the various parties to bear them. The whole risk allocation discussion in the project finance chapter applies in this case, as BOT is a typical privatized project finance approach.

In Diagram 5.4, a typical BOT project is divided into five phases, and the main activities of each phase are presented and interrelated. The role and responsibility of the project sponsors at each phase of the project are described as follows:

1. as CONSULTANTS to carry out the feasibility study during the Preinvestment phase, and the engineering design during the Implementation phase.
2. as PROJECT SPONSORS to negotiate favorable concession agreements from the government, to raise equity and to borrow loans during the Implementation phase.
3. as CONTRACTORS to build the facility usually on fixed-price turnkey basis during the Construction phase.
4. as OPERATOR & OWNER of the facility, using the project revenues to repay the loans during the Operation phase.

For an infrastructure project the concession and construction periods are significantly longer, and since no revenues are available during construction, the rolled-up interest forms a significant part of the overall cost to be financed. The consequence of this distinct characteristic is that project returns to lenders can be very susceptible to delay in the completion of the project. This serves to emphasize that an infrastructure project can be viewed as two distinct projects: a relatively high-risk construction project and a relatively low risk utility project.

After commencement of construction of an infrastructure project, the amount of risks

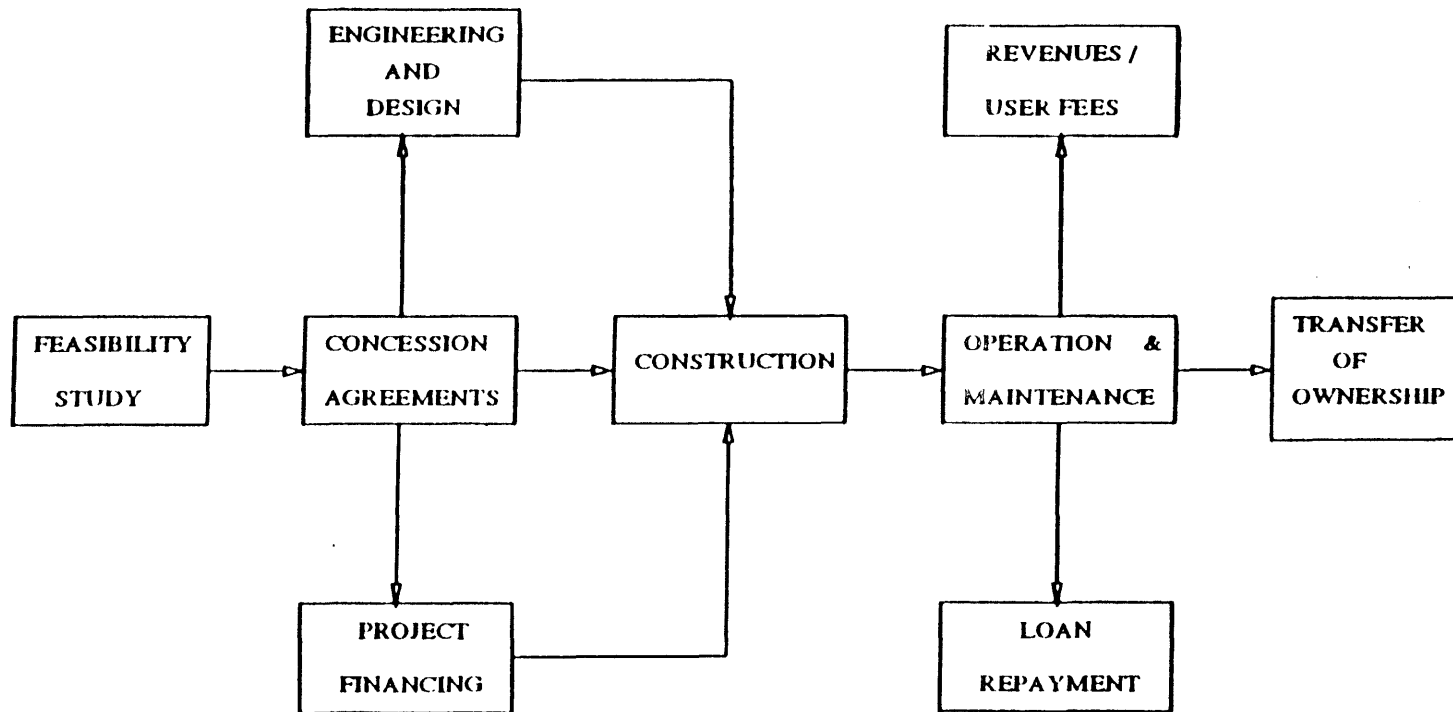
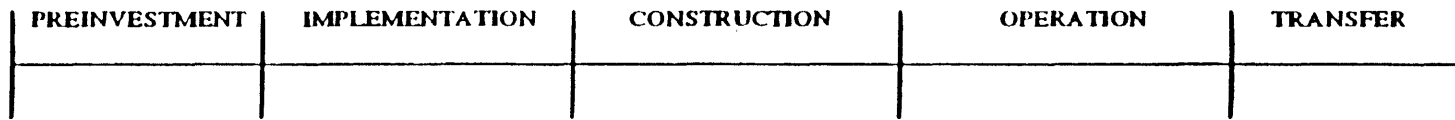


DIAGRAM 5.4 : TYPICAL BOT PROJECT PHASES

SOURCE: TIONG, 1990, A

begins to increase sharply as funds are advanced to purchase materials, labor, and equipment. Interest charges on loans to finance construction also begin to accumulate. The risks would peak in the early operational period when the project is under the greatest pressure due to peak debt servicing. All the funds required for the realization of a capital intensive infrastructure project have been invested, thus the recovery period starts for all those who have offered those funds. Once the project is running to specification, the revenues would be collected from user charges, debts would be paid, and the project sponsors would start recovering their investment with expected profits. It is essential for an investor/creditor to be aware that where the characteristic risk profile of an infrastructure project is apparent, the yield expected must similarly follow two distinct forms: a high yield precompletion and a lower yield post completion. The earlier yield is realized predominantly in the form of capital appreciation in the project's net worth, which rises as construction phase reaches completion, whereas, the later yield is realized predominantly in the form of dividends, once the project becomes a cash generator.

Governments, through BOT limited recourse financing techniques, are trying to avoid the risks involved in major infrastructure projects. The popularity of the method lies in the belief that it may prevent losses and reduce the danger of piling up huge debts. At the same time, governments view the method as an opportunity to promote direct foreign investments in their countries' infrastructure projects. The trend marks a definite move away from recourse deals financed mainly by export credits and loans carrying direct full sovereign guarantees.

On the other hand, for many engineering companies running a project can be a useful diversification. In what is a highly cyclical business it enables them to keep on permanently a higher proportion of their skilled staff, when the construction market is quiet. At the same time it diversifies their income stream.

In Europe, and even more in Greece, infrastructure projects are very political affairs. Therefore, given the high capital costs and typically low returns limited-recourse financing is difficult to apply without an appropriate level of government support particularly with respect to projected revenue levels. Financing could be provided on a project basis to top-up government grants or soft loans.

5.5 THE ROLE OF A STATE DEVELOPMENT BANK IN INFRASTRUCTURE FINANCING

In section 5.5, the financing mechanisms discussed in the sections 5.1 to 5.4 are integrated in the role of a State Development Bank. Initially, in section 5.5.1, a description of how a State Development Bank can potentially contribute to the realization of infrastructure projects, through the reconfigured roles of Financial Advisor and Project Lender, is given. In section 5.5.2 the function of the Infrastructure Bank, the American equivalent of a State Development Bank, is analyzed and criticized. Finally, in section 5.5.3, the influence of the emerging privatization trend to the business environment and role of a State Development Bank is analyzed.

5.5.1 New needs and trends

The high interrelation between economic development and quality of services offered by infrastructure facilities, makes the role of a Development Bank in infrastructure financing critical, especially under the existing economic constraints in international financial markets and in the case that the Bank is owned by the government.

The potential contribution of the Hellenic Industrial Development Bank (ETBA) to the financing of the Greek infrastructure projects has a dual character: first, it can play the

role of the Financial Advisor of the Government, and second, it can play the role of the Project Lender for projects that fall in its capital limits.

I. Financial Advisor: The services which should be offered to the Government by a Financial Advisor are complex and demand great experience and knowledge of the financial mechanisms and instruments existing in the domestic and international financial markets. These services fall in the following general categories:

- define the financial needs of the project, from the time that the development phase starts till the expected end of its economic life. Follow different economic scenarios and select the cash-flow model(s) that most probably represent the project.
- examine whether the required by the project funds can be raised in an efficient way. This means examine whether the following constraints can be met:
 - a) availability of the required amount of funds, considering the appropriate currency, either in local or international markets. In hard economic periods, it is sometimes difficult to find available all the required funds for capital intensive large infrastructure projects in the required time-frame.
 - b) the all-in cost (interest plus direct fee) of the available funds may be high enough to render the project not viable economically, and too high to be justified by the significance of the project.
 - c) the "strings" attached to the available funds, which impose an additional amount of costs, both direct, like legal fees and added labor, and indirect, like management time and loss of operating flexibility, may be excessive enough to cancel the project development. Therefore, it becomes critical for a successful Financial Advisor to have a good network of cooperating banks and other financial institutions, especially if they are a Greek bank and they have to compete with larger foreign ones. In this case, ETBA has the advantage, due to its government ownership, of being eligible to cooperate with EC and manage the available funds

from EC developing programs.

- another issue related with the cost of the available funding is the ability of the Financial Advisor to decompose the specific types of risks in a project, and then shift certain of them to the financiers. The ones shifted are the ones most efficiently (lower price required) borne by particular groups of investors. Thus, the Financial Advisor has to be capable to identify those investor groups who have a competitive advantage in diversifying particular project risks which characterize the structuring project. Generally, this advantage belongs to groups of investors that have one or both of the following characteristics: first, they have investment access, apart from the local market, in well-developed and broad-based financial markets, like the Euromarket; and second, their investment portfolio is independent of the project risk that they are targeted to bear, or even better (ideally) they are negatively correlated so that not only will the risk not be costly for them but they will be also looking for it.
- the Financial Advisor should have the experience and knowledge to unbundle the financing structure. This means separate first the components of traditional financial instruments and second the intermediation services offered by traditional institutions. A government is no longer limited to fixed term, fixed interest rate debt. It can choose the most appropriate -the selection proposal is the Advisor's task- for the specific project, combination of floating interest rate (thus separated from maturity), debt denominated in a foreign currency, and loans issued by banks or other financial intermediaries, even from a foreign country.
- the Financial Advisor has the task to support the government in the negotiations with the contractors for the financial terms of the contractual agreements. This role becomes especially critical when the government plans to follow a project finance structure. In this case the specific detailed terms of the agreement are especially important because the proper risk allocation becomes the key point. Moreover, its duties continue during the consequent project phases in the financial monitoring

of the contractual financial transactions and the project cash flows.

II. Project Lender (or Intermediary): Bankers are quintessential middlemen, channeling money and credit from original lenders to borrowers further down the credit pipeline. Banks can purchase funds - their raw material -from a variety of sources, repackage those raw materials, and then sell them at a higher price. It is important to notice that if the maturity (for purposes of repricing or adjusting the rate) is identical for the bank as borrower and as lender, the bank faces no interest-rate risk. Moreover, the bank charges separate fees for processing and packaging the loan. The fees, which are received upfront, plus the spread, which is earned over the life of the loan, between the price received from the buyer (borrower) and the costs both of purchasing and repackaging the raised funds, are intended to provide profits for the bank. The expected profit must be sufficient to provide an acceptable return on invested capital, one that compensates investors for the risks of default or delayed payment.

ETBA intends to act as the Project Lender for projects, which satisfy specific financial criteria. The idea is that its cooperation bank network and its credit-worthiness will allow it to raise the required capital at a significantly lower all-in cost than if the interested governmental unit attempted to raise the capital, and thus make a profit on the spread of the interest rates plus the transaction fees.

In theory, the primary risk in the financial intermediary business is the probability of default by the borrower. In such a situation the bank cannot pass the consequences of default to the ultimate lenders, as one of the most important services of the intermediaries is to bear this kind of risk, which is incorporated in the interest rate through an implicit premium. In fact when the borrower is a national authority or a government agency, as it mostly happens in infrastructure projects, the probability of default decreases, and the need for a rescheduling agreement becomes more common. In the case of delayed

payments, the bank keeps the right to change the terms of the loan agreement to compensate for the delay and the additional risk. This is called rescheduling and it is profitable for the bank, though it loses the opportunity to change its investment position, as it is stuck with the present borrower longer than it originally expected. Its profit comes through the fees, due and payable immediately, for the repackaging and through the increase of the interest rate.

The economic criteria examined by a bank before a lending transaction is undertaken include the following:

- analytic scenarios concerning the amount of capital which will be required and the time-frame according to which it will be withdrawn. A representative cash-flow model has to be built.
- define the amount of funding that it can raise for the specific project risks at a competitive rate and examine whether its capabilities at the time meet the expected project needs.
- examine the economic viability of the project and the sources through which the governmental unit will satisfy its debt service. In the case of project finance structures the task of examining the project viability gets top priority as the project itself is the guarantee for the debt service repayment.
- diversify its risks, which means to spread its available for project financing funds among a number of projects whose risk and return structure differ (or ideally they are negatively intercorrelated). In this way it reduces the impact and consequently the price (demanded corresponding return) of specific risks. Moreover, the amount dedicated to each project should not exceed a predefined percentage of the bank's available capital for security and creditworthiness reasons.

ETBA has the advantage, as a government owned bank, of being eligible to raise EC funds provided by EIB and/or EFRD which cannot be raised by competitive private

banks. Such funds, which are offered for specific type of projects and under very competitive terms, not only do they enlarge significantly the project budget range that ETBA could otherwise afford to finance, and but they also place it at a highly competitive position compared to larger private foreign banks.

Another issue raised is that in order to create the cash flows model and evaluate the viability of the proposed projects, it is essential that technical expertise and insight is available. ETBA can face this constraint through its extended internal technical department and through a 100% self-owned engineering company with expertise in industrial development planning and management.

The restrictions of ETBA's lending capacity can be decreased by the use of some of the financial vehicles that facilitate the sale of loans, some of which allow an originating bank to maintain partial ownership of the loan and/or responsibility for its management. Participations, Syndications, and Asset Sales are common examples of such activities undertaken by banks:

** Participations: A participation loan is a single loan made to a large borrower by more than one lenders. Participation loans are made when the Lead Lender (Project Lender) cannot lend to a large borrower because of legal, internal, or capacity lending limits restricting the amount of capital that can be raised or loaned to one borrower or classification of borrowers. The Project Lender originates the transaction and maintains responsibility for servicing the loan. Many loan participations come about through correspondent banking relationships. A correspondent bank performs services for another bank in a market that is inaccessible to the other. Both banks have to evaluate the creditworthiness of the borrower and independently decide to enter into the participation. While credit decisions are made independently, risk may not always be shared equally in participations. Some participations are structured on a last in first out (LIFO) basis

so that the originator, or first in, takes a larger portion of the risk associated with the participation loan.

** Syndication: Syndications are similar to loan participations, except that the syndicate members lend directly to the borrower. An originating bank, called Lead Bank or Manager (Project Lender), arranges a credit facility for a large borrower. The bank then sells off portions of the loan to other lenders. The syndicate members' obligations are separate: one lender is not responsible for the commitment of another, however, the rights and obligations of all the parties (the syndicate members and the borrower) are governed by one common agreement, the Syndication Loan Agreement. Each participant in a syndication shares in the loan's risks and makes its own credit decision. There are two types of syndicates: best-efforts, and firm (or underwritten) commitment. In best-effort syndicate the Project Lender will market the loan under the agreed-upon terms and conditions, but if the syndication is not fully subscribed, the loan will not be made and the Project Lender retains no legal obligation to the borrower. In a firm commitment syndication the Project Lender agrees to make the loan regardless of its ability to fully syndicate it. In a syndicate, a borrower pays certain fees in addition to interest on the loan:

- a) a commitment fee based on the amount of the credit and the undrawn portion,
- b) a management fee paid to the Project Lender as compensation for assembling the syndicate and servicing the loan, and
- c) participation fees (range from 0.25% to 1.50%) to syndicate participants based on the amount of their commitments.

** Asset Sale: A relatively recent development has been the sale of loans to third parties. An Asset or Loan Sale is similar to a syndicate except that the Project Lender initially takes the credit on its books and then sells off most or all of the credit, retaining little or nothing for its own portfolio. In this transaction all the risk, from the sold portion, is eliminated for the originating bank (Project Lender),

and the loan is removed from its balance sheet. The bank earns a fee for its efforts in originating the loan.

5.5.2 USA: Infrastructure Bank

The main objective of the Infrastructure Bank is the creation of a permanent pool of funds to finance infrastructure projects. The main functions offered by the bank are summarized as:

- they are structured to provide a permanent pool of capital for infrastructure investment projects
- they are urged to take a far more active role in determining how investment money will be effectively spent. Allocating criteria, are a combination of project viability, so that the money invested can be returned to the bank in a logical period, and project's expected contribution to economic development.
- financial assistance is often accompanied by requirements and consultancy to improve the capital planning and management practices of local borrowers. It is essential to evaluate the precision of the budget, and the commitment of the local authorities into maintaining the budget.

The Bank can raise the initial investment capital and get capitalized (receive equity financing) from a great variety of sources, including the following ones:

- dedicated taxes,
- initial government grants,
- private capital,
- dedicated bond issues, and
- earnings of the Bank functions.

Once capitalized, the Bank is expected to grow into a sustainable revenue stream that will

not depend on direct government grant assistance. The Bank functions by providing funds to the Bank's users (governmental units and municipalities) through the mechanism of revolving loans. The basic idea behind the revolving loan mechanism is to raise an initial capital, which then will be used efficiently and recycled. The mechanics of revolving fund is best summarized in Diagram 5.5.

The principal objectives of the Infrastructure Bank may be summarized in the following main points:

- to maximize the use of limited funds available for new infrastructure projects,
- to provide a steady and long range commitment of funds for the repair, maintenance, and modernization of infrastructure facilities,
- to reduce the need for government's general obligation debt to support the infrastructure needs,
- to support borrowing to governmental units through dedicated taxes, which do not invoke the government's full faith and credit backing, through self-generating revenues, and through the revolving loan fund mechanism,
- to provide permanence, visibility, and professionalism to the provision of infrastructure services,
- to use their influence with borrowers to encourage efficiency in the provision of infrastructure, by applying properly calculated user fees, by enforcing improvements in the capital-budgeting process and by encouraging better maintenance practice.

The maintenance, and therefore the overall success of the mechanism, of the self-supporting character of the Infrastructure Bank is based on three interrelated factors:

- the quality of the revenue stream: it is essential to maintain a balance between the inputs from the revenue sources and the debt repayment responsibilities of the Bank to its funding sources. In order to achieve such a balance the Bank will have

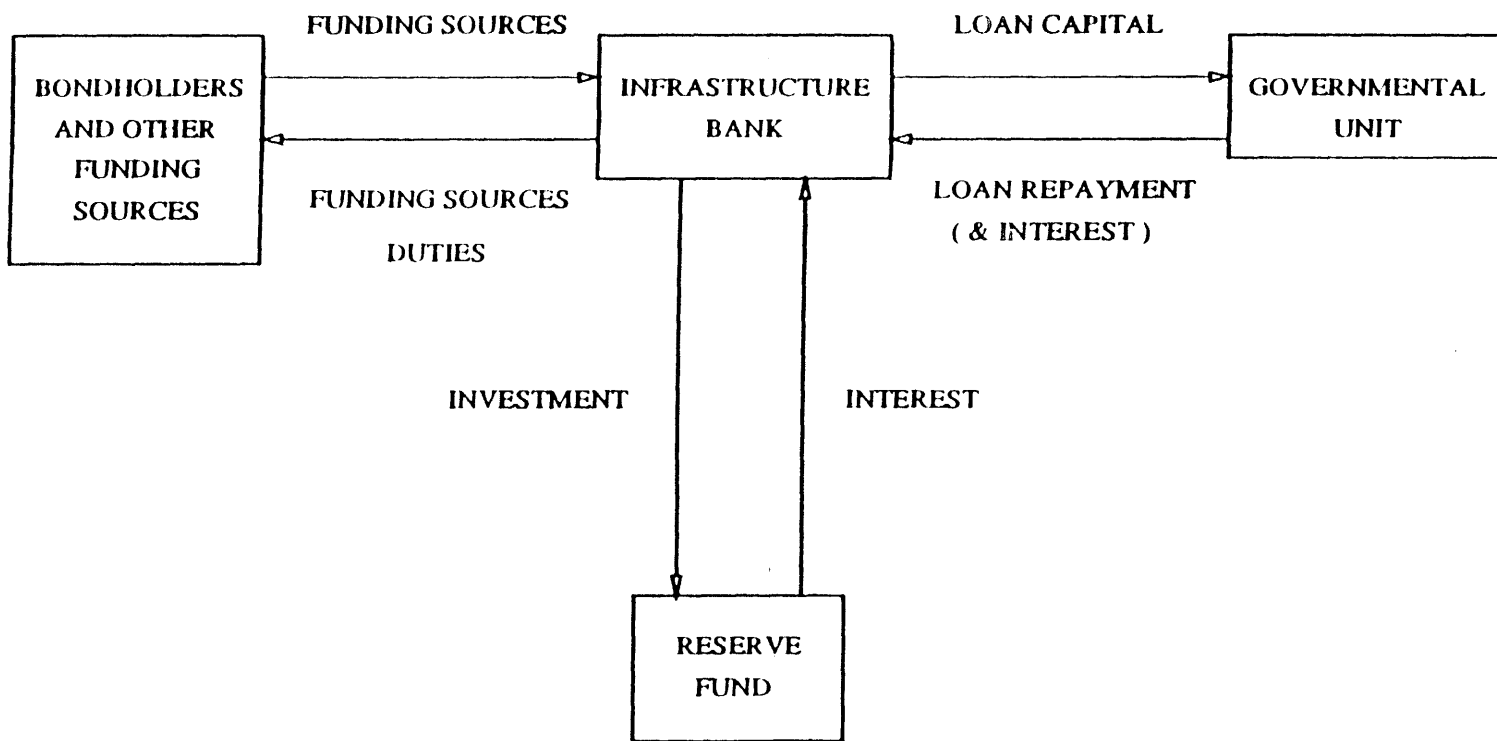


DIAGRAM 5.5 : MECHANICS OF A REVOLVING FUND

SOURCE: HUMPHREY et al., 1985

to focus on designing a predictable revenue stream, undependable of potential interest rate volatility.

- the quantity of the revenue stream: a reserve fund, invested in high-quality, short-term government securities, will enable the bank to have adequate funds to meet debt service repayments in case that loan repayment shortfalls occur, or interest rates fall beyond any prediction, or any case when revenues are not sufficient to service the outstanding indebtedness.
- the Bank's overall creditworthiness: it refers to the Bank's ability to repay its debt. It is affected by the existing demand for loans, by the economic incentives for continued loan repayment, and by sound internal financial control. Competitive lending rates, lower than what the governmental units could receive independently, and diversity in lending, which prohibits in a way the financing of very large, compared to the Bank's borrowing ability, projects, predictably lead to fewer repayment problems.

The critics of an Infrastructure Bank focus on the following two main issues:

- they argue it would be difficult to insulate the bank from political pressures at the municipal or government level. This problem becomes extremely critical in Greece, where the government influences and, in fact, completely controls all the public management based on political criteria.
- they say the Bank, trying to keep a good credit rating might be too cautious in selecting projects to which they lend. Only projects with relatively secured revenues would be funded, which are not the ones for which the Infrastructure Banks are proposed.

If the above extremes were to occur, although the Infrastructure Bank would decrease the all-in-costs of the borrowing, the sum of the loans offered to municipalities for infrastructure projects would not increase. Even if the absolute number were higher, the

increase would not be result of additional funds made available for projects which with the traditional methods face serious funding constraints.

5.5.3 Development Banks and Privatization

Growing restraints on the ability of governments, states, and municipalities to raise the capital they need for expanding and renovating public works and services are creating new pressures and new opportunities for state development banks (SDB)²¹, both to better satisfy their social role and to increase their business profits.

As more and more governments and public officials are looking into privatization, SDB can serve their public and private clients by introducing new ways to bring together private and public resources in mutual beneficial ways. Since, privatization is a complicated arrangement, it is imperative that bankers have a firm understanding of the political, technical and financial concepts involved. While an SDB may not have the experience of privatization deals, it can profitably team up with institutions that have strong privatization expertise; by combining its deep knowledge of local financial and political conditions and needs, its local network, and its government connections and inherent support, with a specialist bank's expertise and financial resources, an SDB can serve its clients efficiently, and, at the same time, it can gain valuable knowledge and become cobeneficiary of successfully financed projects.

Clearly, privatization is an idea whose time has come. Its expansion will place new government and market pressures, and new demands, on regional development banks to reorient their traditional lending practices. It will generate new development opportunities

²¹ SDB refers to regional (most probably on a country level), government-owned development banks, like the Hellenic Industrial Development Bank.

and business possibilities, including:

- broader participation in development ventures concerning infrastructure projects which combine public and private interests and resources, either fee-based or asset-based.
- opportunities to provide consulting expertise, such as project advisory services, feasibility analysis, and management and marketing consulting. Their first potential client is the government/owner. Therefore they have a market entrance ready, which they have to further cultivate.
- debt/equity placement opportunities.
- long-term relationships with municipalities and developers. In this way they can better satisfy the demand and need for efficient use of public financial sources.
- the opportunity to generate transactions and provide leadership in the area of development planning, both within the government and within the local community. They can act as the connection between public and private sector.
- investment's opportunities for the bank's own money
- exploitation of financial sources, which are provided only for government-owned corporations and which consequently suffer from inefficient use. The private/public partnership may raise the credibility of the borrower, by offering more chances of efficiency.

Development Banks must seek a match between the governments' and municipalities wills and needs, the privatization financing opportunities, and their own business needs. Under this principles the role proposed in the following chapters for the Hellenic Industrial Bank of Greece was cultivated.

Chapter 6

WASTEWATER TREATMENT TECHNOLOGY

6.1 Focus of interest

Wastewater is the liquid effluent of a community. This spent water is a combination of liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, plus groundwater, surface water, or storm water.

Wastewater may be grouped into four main classes:

- Class 1.: Effluents that are non-toxic and not directly polluting but liable to disturb the physical nature of the receiving water. They can be improved by physical means.
- Class 2.: Effluents that are non-toxic but polluting because they have an organic content with high oxygen demand. They can be treated for removal of objectionable characteristics by biological methods. The main constituent of this class of effluent usually is domestic sewage. This class may also include storm water and wastes from dairy product plants and other food factories.
- Class 3.: Effluents that contain poisonous materials and, therefore, are often toxic. They can be treated by chemical methods. When they occur they are generally included in industrial wastes, for example, those from metal

finishing.

Class 4.: Effluents that are polluting because of organic content with high oxygen demand, and in addition, are toxic. Their treatment requires a combination of chemical, physical, and biological processes.

The three main categories of wastewater are:

1. Domestic wastewater is collected from dwelling units, commercial buildings, and institutions of the community. It may include process wastes of industry as well as groundwater infiltration and miscellaneous waste liquids. It is primarily spent water from a building water supply, to which have been added the waste materials from the bathroom, kitchen, and laundry.
2. Storm water is precipitation collected from property and streets and carrying with it the washings from these surfaces.
3. Industrial wastes are primarily the specific liquid waste products collected from industrial processing but may contain small quantities of domestic sewage. Industrial wastes, as distinguished from domestic wastes, are related directly to processing operations and usually are the liquid fraction of processing that has no further use in recovery of a product. These wastes may contain substances that, when discharged, cause some biological, chemical, or physical change in the receiving body of water.

For the Greek case study, the focus is on Nontoxic (Classes 1. and 2.) Domestic Wastewater, originating from coastal municipalities.

6.1.1 Domestic Wastewater

Usually, wastewater contains less than 0.1% of solid matter. Much of the flow looks like bath or laundry effluent, with garbage, paper, matches, rags, pieces of wood, and feces

floating on top. Within a few hours at temperature above 40 degrees F, wastewater becomes stale. Later, it may become septic, often with the odors of hydrogen sulfide, mercaptans, and other sulfur compounds predominating. The more putrescible compounds there are in wastewater, the greater is its Concentration or Strength.

The main characteristic of domestic wastewater are:

1. Solids: Total solids in wastewater comprise suspended and dissolved solids. About one-third of the total solids usually are in suspension. Suspended solids are those that can be filtered out on an asbestos mat. Usually more than half of these solids are organic material.

Suspended solids include settleable solids and colloids. Settleable solids precipitate out in sedimentation tanks in the usual detention periods. Colloids, mostly organic material are smaller than 0.0001 mm in diameter and can remain in suspension indefinitely. They can pass through filter paper but are retained on a filtering membrane. Elimination of suspended solids from wastewater is desirable because they contain insoluble organic and inorganic pollutants and harbor bacteria and viruses.

Dissolved solids are the residue from evaporation after removal of suspended solids. Excessive dissolved solids can have adverse effects on living things, taste, irrigation, and water softness.

2. Organic Content: The organic content of wastewater may be classified as nitrogenous and non-nitrogenous. Principal nitrogenous compounds include proteins, urea, amines, and amino acids. Principal non-nitrogenous compounds include soaps, fats, and carbohydrates.

3. Bacteria: These may be: Aerobic, requiring air for survival; Anaerobic, thriving without air; or Facultative, carrying on with or without air. Bacteria are generally useful in

stabilizing wastewater, breaking it down into substances that do not decompose further. Some may be pathogenic, causers of intestinal diseases, in which case the effluent may have to be chlorinated or otherwise treated to eliminate such bacteria, depending on the method of disposal. Anaerobic bacteria are used in sludge digestion, which is the stabilization of organic material removed from sewage by sedimentation. Aerobic bacteria serve in self-purification of streams, trickling filters, and the activated sludge method of treatment.

4. Biochemical Oxygen Demand (BOD): The amount of oxygen used during decomposition of organic material is the BOD. It is a measure of the amount of biodegradable organic material present. If the BOD of wastewater discharged into a stream or lake exceeds the oxygen content of that water, the oxygen will be used up and the stream or lake will become septic at the discharge area.

6.1.2 Categories of Wastewater Treatment

Because of the objectionable characteristics of raw domestic sewage, disposal requires consideration of many factors, especially health hazards, odors, appearance, and other nuisance conditions, as well as economics. Rarely do conditions exist that permit low-cost disposal of raw sewage. Usually, some degree of treatment is necessary. Selection of the type and degree of treatment depends on: the nature of the raw wastewater; effluent quality after treatment; initial cost of the treatment plant; costs of operation and maintenance; process reliability, capability for disposal of sludge produced; potential of air pollution from pollutants removed; treatment chemicals required; energy consumed in the process; space requirements for the treatment plant; and potential hazards within the plant and in the surrounding area if the plant malfunctions or during transport of materials to and from the plant.

Wastewater treatment is any process to which wastewater is subjected to remove or alter

its objectionable constituents and thus render it less offensive or dangerous. Treatment may be classified as preliminary, primary, secondary, or tertiary or advanced, depending on the degree of processing.

1. Preliminary treatment or pretreatment may be the conditioning of industrial waste before discharge to remove or neutralize substances injurious to sewers and treatment processes. It may involve unit operations that prepare the wastewater for major treatment.

2. Primary treatment is the first and sometimes the only treatment of wastewater. This process removes floating solids and suspended solids, both fine and coarse. If a plant provides only primary treatment, the effluent is considered only partly treated.

3. Secondary treatment applies biological methods to the effluent from primary treatment. Organic matter still present is stabilized by aerobic processes.

4. Tertiary or complete treatment removes a high percentage of suspended, colloidal, and organic matter. The wastewater may also be disinfected.

5. Advanced waste treatment is any physical, chemical, or biological process that accomplishes a degree of treatment higher than secondary.

6.2 Technology strategy for coastal and tourist areas

The focus of this study is on coastal municipalities in Greece, a great number of which serves as tourist resorts. In this section, issues which should influence the technology strategy in the specific areas are discussed.

The choice of technology to be used for treatment of wastewater from coastal tourist areas should be based upon the following criteria [Odegaard, 1989]:

- a. Effluent requirements before discharge to the sea.
- b. Characteristic of wastewater from tourist areas.
- c. Suitability of treatment method in relation to (a.) and b. .

The most characteristic feature about flow and composition of wastewater from tourist areas is that it varies a lot. It varies both over the season and the day. It varies with the standards of tourist establishment (i.e. hotel, camping) and with the type of activity which takes place within the area. A number of studies concerning wastewater from coastal tourist areas have shown that it is like the municipal -domestic- wastewater, only being [Nikolaou and al., 1987] :

- more concentrated in terms of typical pollutant parameters,
- more variable in terms both of flow variation and contaminant variation,
- less disintegrated in terms of particulate matter as a result of a short sewerage system.

Therefore, the technology strategy for coastal and tourist municipal wastewater should provide a system with the following characteristics:

- a) high removal rate of suspended solids, because:
 - more than half of the organic matter is associated with the suspended solids [Munck et al., 1980]
 - the organics in particles are found to be degradable biochemically at a much slower rate than the soluble organic rate. Tests have shown that the biochemical oxidation rate decreases with increasing particle size [Richert et al., 1971]
 - the amount of phosphorus and nitrogen, which are two major pollutants, associated with particles is found to be significant [Munck et al., 1980]
 - other contaminants, such as metals, bacteria, viruses, and organic micropollutants are strongly associated with particles [Odegaard, 1989].
- b) significant improvement of the hygienic property of the wastewater, especially if it is discharged to publicly used coastal zones, such as beaches
- c) a moderately high removal of organic matter, because:
 - in coastal waters, high levels of BOD removal are not as critical due to the

large surface area available for recreation.

- d) can accommodate seasonal and daily variation both in flow and wastewater composition.
- e) is easy to operate and economically accepted.

6.3 Synoptic presentation of Conventional and Chemically-Enhanced wastewater treatment technologies

In the next four sections the basic characteristics of a selected group of treatment systems are described; these systems are Primary Treatment (conventional), Biological Secondary Treatment (conventional), Advanced Primary Treatment (chemically enhanced), and Chemical Secondary Treatment. Finally, in the last two sections a performance-based and a cost-based comparison of the four systems is discussed. Conventional treatment methods are currently implemented in Greece and in the majority of the world. The chemical systems are implemented in a limited number of plants, most of which are in Scandinavia and California, with significant success both from a performance and an economic point of view.

6.3.1 Conventional Technology

6.3.1.1 Primary Treatment

The Primary Treatment (PT) process includes the following steps:

- pre-treatment,
- grit removal chamber,
- primary sedimentation,

In this process Total Suspended Solids (TSS) and BOD removal occurs through the

settling of particles contained in the raw sewage. Discrete particle settling, where gravitation forces dominate, is the only active removal. PT removes particles larger than 40 μm .

In Diagram 6.1 the rate of TSS and BOD removal in Primary Treatment as a function of the Overflow Rate²² is shown [Harleman et al. 1991, B].

6.3.1.2 Biological Secondary Treatment

The Biological Secondary Treatment (BST) process includes the three steps of PT followed by a biological process. The primary effluent is directed to tanks where conditions favor the growth of bacteria that absorb further components from the wastewater, particularly to enhance organic particles removal. There are two types of biological treatment processes:

1. Activated sludge It consists of aeration basins, settling tanks, and return sludge equipment. The mechanisms involved in the removal of pollutants are the transformation of colloidal and dissolved organic particles into bacterial life and growth, flocculation, and sedimentation. To transform the soluble fraction and organic particles into bacterial growth and energy, oxygen is required. Lack of sufficient oxygen leads to failure of the method. Flocculation occurs naturally because of the affinity of the biomass to settle more rapidly in settling tanks. In Diagram 6.2 a schematic of a conventional activated sludge process is shown.
2. Trickling filter It consists of a filter media in an enclosed basin where wastewater is distributed over the media, sludge recycling equipment (if necessary), and settling tanks. The mechanisms involved in the removal of pollutants are the

²² Overflow Rate: the volume rate of flow through the plant divided by the total surface area of the settling tanks (see section 6.4.1)

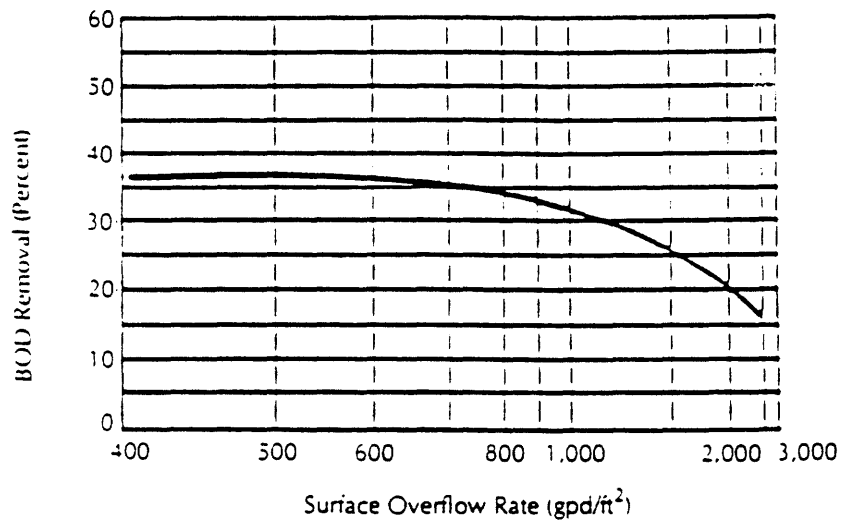
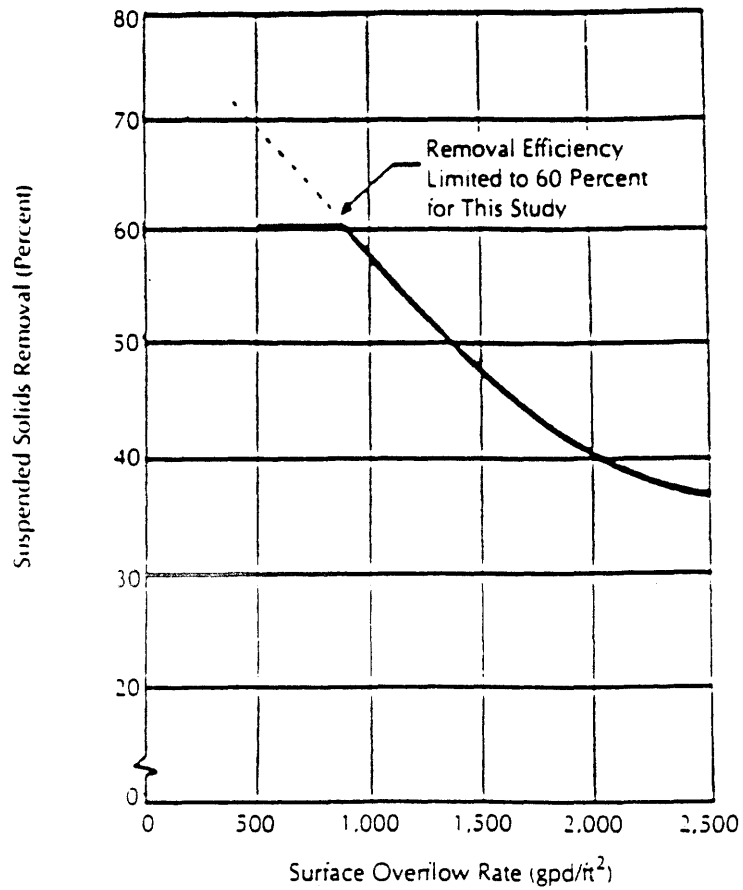


DIAGRAM 6.1 : TSS AND BOD REMOVAL RATES VERSUS OVERFLOW RATES IN PT

SOURCE: HARLEMAN et al., 1991, B

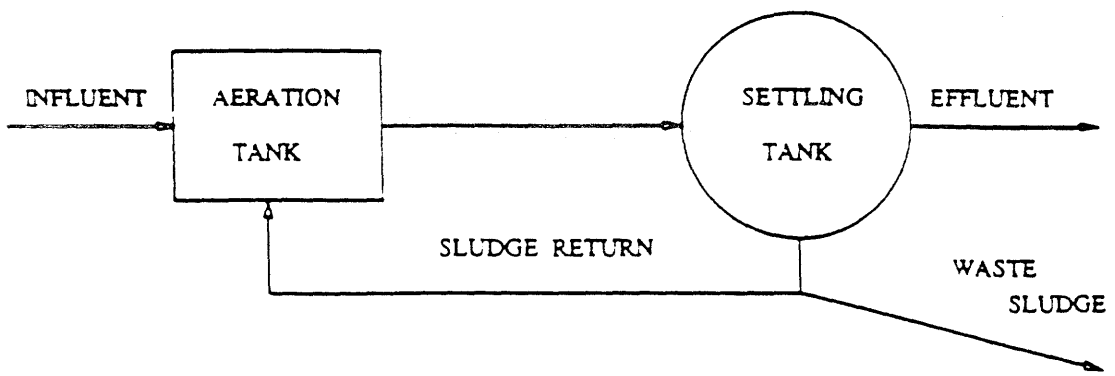


DIAGRAM 6.2 : SCHEMATIC OF CONVENTIONAL ACTIVATED-SLUDGE PROCESS

SOURCE: METCLAFF et al., 1990

transformation of colloidal and dissolved organic particles into bacterial life and growth functions. In this process, micro-organisms adhere to the media. Once the build-up of the organisms is too great, they slough-off and this sludge is pumped either to the primary clarifiers, to the beginning of the trickling filter, to a second stage filter, or to an additional clarifier. In Diagram 6.3 a schematic of a trickling filter process is shown.

6.3.2 Chemically Enhanced Treatment

6.3.2.1 Advanced Primary Treatment

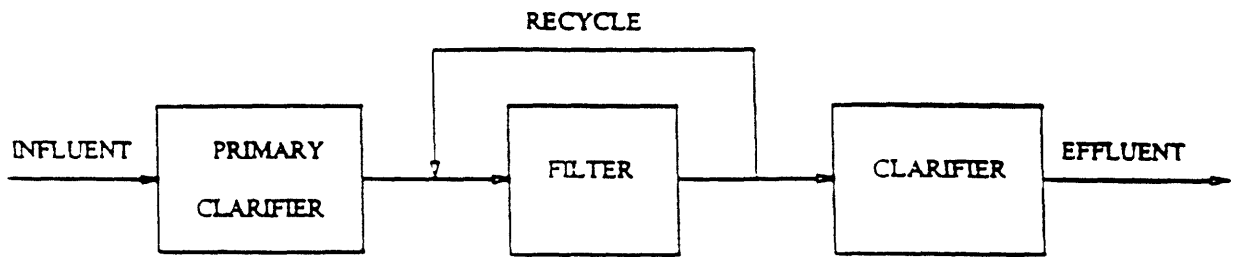
The Advanced Primary Treatment (APT) process includes the following steps:

- pre-treatment,
- grit removal,
- primary sedimentation,

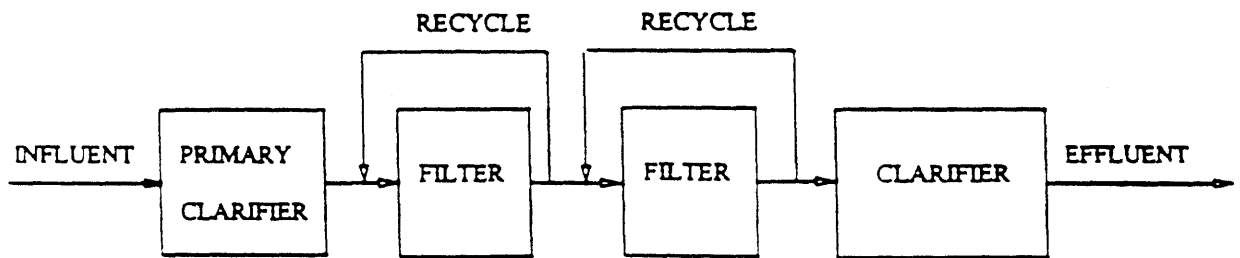
as in PT, plus

- addition of small quantities of a coagulant before sending the effluent into sedimentation tanks.

In Advanced Primary Treatment anorganic metal salts (such as ferric chloride, alum and lime) and/or polymers are added to the wastestream to enhance coagulation and settling. Metal salt (20-30 mg/l) (the coagulant agent) needs rapid mixing in order to optimize the coagulation process. Therefore, it should be added as far upstream of the grit chamber as possible to allow enough mixing time for coagulation to occur. The polymer (0.2-0.3 mg/l) is added ahead of the grit chamber. Coagulation removes particles larger than 0.1µm. In Diagram 6.4 a schematic of an APT system is shown. Examples of plants where the APT process is implemented are "Sarnia, Ontario, Canada" and "Point Loma, San Diego".



A. SINGLE - STAGE



B. TWO - STAGE

DIAGRAM 6.3 : SCHEMATIC OF TRICKLING FILTER PROCESS

SOURCE: METCLAFF et al., 1990

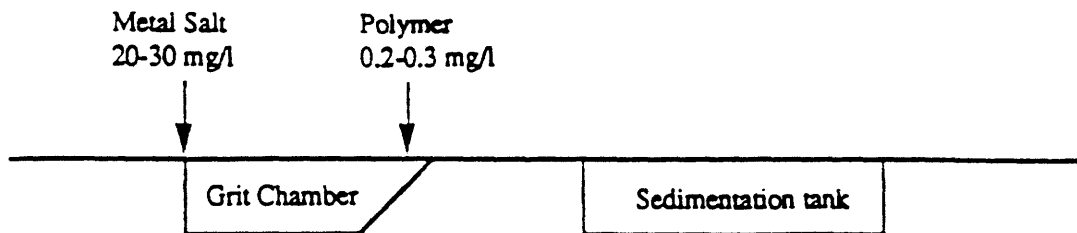


DIAGRAM 6.4 : SCHEMATIC OF AN APT PROCESS

SOURCE: MORRISSEY, 1990

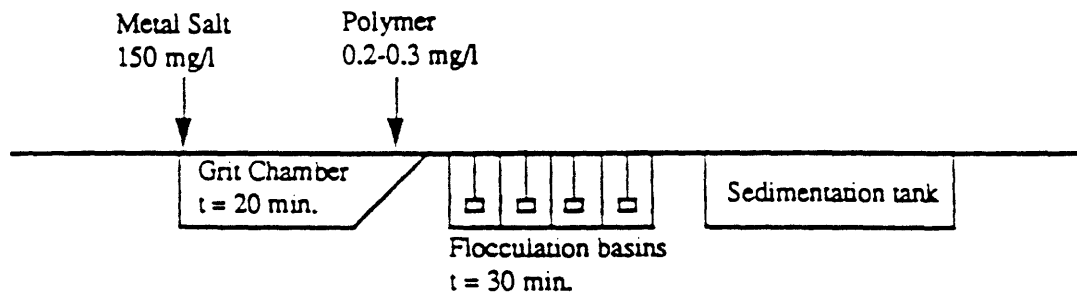


DIAGRAM 6.5 : SCHEMATIC OF A SINGLE STAGE CST PROCESS

SOURCE: MORRISSEY, 1990

6.3.2.2 Chemical Secondary Treatment

The term Chemical Secondary Treatment (CST) can be attributed to any process which uses floc-forming chemical additives in order to meet EPA requirements for secondary treatment²³. CST can be distinguished in two categories:

- a. single stage (CS-1) includes the following steps:
 - pretreatment
 - grit removal
 - flocculation
 - primary sedimentation
 - chemical addition (larger quantities than APT)

CS-1 utilizes about 150 mg/l of a metal salt (compared to 20-30 mg/l for APT) and 0.2-0.3 mg/l of polymer. The difference between CS-1 and APT is that flocculation basins are provided before the sedimentation tanks to maximize the flocculation process and that a larger quantity of chemical salts is added. The flocculation basins are in series and the mixing rates become progressively slower. The metal salt is added approximately 20 minutes upstream of the flocculation basins. The polymer is added before the flocculation basins. It is mixed with the wastewater and metal salt for approximately 30 minutes before reaching the sedimentation tanks. In Diagram 6.5 a schematic of a single stage CST is shown. Most examples of CS-1 come from Scandinavia, and especially from Norway.

- b. double stage (CS-2) is a sequential combination of an APT and a Biological Secondary process. The additional TSS and BOD removal by APT compared to PT results in a secondary biological plant that is more efficient and smaller, as

²³ EPA requirements for secondary treatment: all publicly owned wastewater treatment plants achieve effluent limits of 30 mg/l of TSS and BOD (30-day average) and 85% removal of TSS and BOD.

smaller quantities and sizes of particles have to be treated. Example where a double stage process is implemented, is the plant at "Hyperion, Los Angeles", where Activated Sludge is used for secondary treatment (Diagram 6.6 adapted from Harleman et al., 1991, B).

6.3.2.3 Chemical additives

There are two categories of chemical additives that can be used to enhance performance of a wastewater treatment plant; Natural Organic Compounds and Polymers.

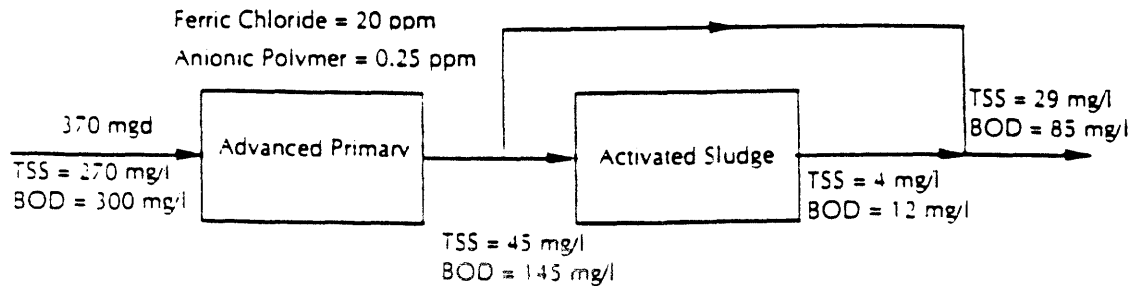
A. Natural Anorganic Compounds

1. Alum [$\text{Al}_2(\text{SO}_4)_3 \cdot 18 \text{H}_2\text{O}$] is very effective in terms of sweep coagulation²⁴, if used in large amounts. The larger the quantity of alum used, the larger the amount of sludge²⁵ produced. The sludge generated is harder to dewater than the sludge generated by destabilization.

2. Lime [$\text{Ca}(\text{OH})_2$] is highly dependent on the pH and alkalinity of the wastewater. It requires pH values close to 11. This may be costly if the initial pH is very low since it is expensive to raise pH from 8 to 9. However, the cost to incrementally raise pH decreases with increasing pH. In large quantities, lime is effective in terms of sweep coagulation. The amount used can be reduced by recycling the sludge water which is high in pH. Lime sludge, though it is voluminous, is easy to dewater.

²⁴ Sweep Coagulation: a large amount of metal salt is added to the wastewater so that the metal hydroxides formed by precipitation settle very rapidly. When they precipitate, they carry with them smaller colloidal size particles.

²⁵ Sludge is the by-product of any treatment that removes solids from the waste stream. The sludge produced during precipitation -which is what chemicals enhance- has higher water content and is voluminous.



Advanced Primary Only:
Removal of TSS = 83%
Removal of BOD = 52%

Advanced Primary Plus Activated Sludge:
Removal of TSS = 99%
Removal of BOD = 96%

DIAGRAM 6.6 : SCHEMATIC AND PERFORMANCE OF HYPERION TREATMENT FACILITY

SOURCE: HARLEMAN et al., 1991, B

3. Ferric Chloride [FeCl_3] is very effective in terms of sweep coagulation if used in large amounts. The larger the quantity of Ferric Chloride used, the larger the amount of sludge produced. The sludge generated is harder to dewater than the sludge generated by destabilization.

4. Seawater contains metal salts of Ca, Mg, Na and other metals which enhance coagulation. It is obviously very cheap for coastal areas and in Norway where it has been consistently used has proved to be very effective. It can be used either alone or in combination with lime, which is the Norway case [Odegaard, 1990].

In a lime/seawater plant, a few percent (3-5%) of seawater is blended continuously in the raw wastewater before lime is added. The beneficial effect of the added seawater is generally a better effluent quality at a reduced lime dosage. It improves the removal of particulate matter, including phosphorus, at normally insufficient lime dosages. Its effect in the mechanics of the process is particle destabilization, aggregation, and thus improved settling. The theory behind these effects of seawater addition, though not 100% explained, claims that the enhanced performance is the result of increased magnesium concentration leading to increased precipitation of the very flocculent $\text{Mg}(\text{OH})_2$ [Idelovitch et al., 1978]. The amount of seawater needed depends, therefore, on the solubility of magnesium hydroxide, which is a function of pH. As little as 1 - 2% seawater is needed if pH values above 11 are used. The drawback of the process is the relatively high sludge production. Reduced lime dosages give reduced sludge production, but on the other hand increased magnesium precipitation will result in higher sludge production. Still total sludge produced will be less in the lime/seawater process than in the lime process. The advantage is that the sludge settles and thickens very well resulting in a more moderate sludge-volume production.

B. Polymers

Polymers are very effective in terms of colloidal destabilization. The mechanics of the destabilization process involve one of the following two:

- oppositely charged particles are absorbed onto the polymers, or
- polymers "bridge" the small region between two particles that repel each other.

The major advantage of polymers is that as they are highly charged are, they can readily destabilize particles. This reduces the amount of metal salts required and consequently the amount of sludge produced. Odegaard et al. (1990) have shown that metal salts (they tested Alum) can be replaced by a cationic polymer at a ratio 7.5 : 1 without affecting removal rates for TSS and BOD. At the same time the amount of sludge produced is dramatically reduced. The disadvantage is that the cationic polymer does not precipitate phosphorus.

6.4 Evaluation of alternative treatment systems for coastal and tourist municipalities

In the following sections, the four systems described in the previous sections will be criticized and evaluated from both a performance and a cost point of view.

6.4.1 Performance evaluation

In general, wastewater treatment processes depend on gravity to allow particles to settle out in large settling tanks. Removal efficiency in a given plant is directly related to the number of modular settling tanks used.

The efficiency is evaluated on the basis of % removal and concentration in the treated effluent of conventional pollutants -Suspended Solids and BOD-, Nutrients -Phosphorus

and Nitrogen-, and contaminants -heavy metals. The variable used to compare and predict plant performance is the volume rate of flow through the plant divided by the total surface area of the settling tanks. This ratio is known as the "overflow rate" and is expressed in gallons per day per square foot (gpd/ft²).

The criteria of the comparison used in this thesis will be removal rates for TSS, for BOD, for the conventional pollutants P and N, other contaminants, and sludge production. Each time the performance will be connected with the required overflow rate.

1. BOD and TSS removal rates:

In Table 6.1 [Harleman et al., 1990, A] TSS and BOD removal rates for PT, APT, BST, and single stage CST are given. In Diagram 6.6 [Harleman et al., 1991, B] removal rates achieved in the Hyperion, Los Angeles plant, where CS-2 -APT plus Activated Sludge- is implemented are given. In Table 6.2, national (U.S.A.) averages of TSS and BOD removal rates for PT, APT, BST, and CS-2 are calculated, based on influent and effluent concentrations quoted from Murcott, 1991.

2. P and N removal rates:

In Table 6.1, P removal rates for all four systems are provided. The problem with BST is that the process produces nitrogen. Produced nitrogen and low removal of P stimulate algal growth and subsequent algal decomposition provides a new source of BOD that tends to nullify the high BOD removal [Morrissey, 1990]. In Table 6.2 national (U.S.A.) averages of P removal rates for PT, APT, BST, and CS-2 are calculated, based on influent and effluent concentrations estimated by expert engineers and quoted from Murcott, 1991. In Norway, chemically enhanced treatment is used for the high performance it demonstrates in nitrogen removal [Odegaard, 1990, A].

3. Other contaminants

The high TSS removal rates of the chemically enhanced systems ensure a higher removal rate for other contaminants, such as viruses, bacteria and heavy metals, which are

Treatment Type	TSS Removed	BOD Removed	P Removed	Sludge Produced (Dry wt. / day)
Primary	60%	35%	20%	X
Advanced Primary ¹ (Polymer + FeCl ₃)	80%	57%	85%	1.33 X (TSS) <u>0.12 X (Chemicals)</u> 1.45 X (total)
Biological Secondary ²	85%	85%	30%	1.42 X (TSS) <u>0.48 X (new Biomass)</u> 1.90 X (total)
Chemical Secondary ³ (Polymer + FeCl ₃)	91%	80%	95%	1.53 X (TSS) <u>0.47 X (Chemicals)</u> 2.00 X (total)

1. Advanced Primary (Polymer) Treatment results are from San Diego, CA – Pt. Loma plant operations data (Langworthy, 1990)
2. Biological Secondary Treatment results are from Black & Veatch Inc., Boston, MA, January 1988. Residual Management Facilities Plan: Draft Characterization of Residuals, Suppl. Rep. No. 1. Prepared for MWRA.
3. Chemical Secondary Treatment results are from Oslo, Norway (Paul Sagberg, 1990)

TABLE 6.1 : EFFECTIVENESS OF DIFFERENT WASTEWATER TREATMENT PROCESSES

SOURCE: HARLEMAN et al., 1990, A

SYSTEM	BOD (%)	TSS (%)	P (%)	SLUDGE	
				RAW (100 lb/MG)	DIGESTED
PT	40-60	68-80	25-50	10-14	5- 8
APT	68-80	84-92	75-88	15-22	8-16
BST	92-96	92-96	38-63	21-27	13-17
CS-2	92-96	92-96	88-94	29-36	18-26

TABLE 6.2 : NATIONAL AVERAGE REMOVAL PERCENTAGES AND SLUDGE PRODUCED FOR PT, APT, BST, AND CS-2 SYSTEMS

SOURCE: MURCOTT, 1991

associated with suspended solids.

4. Sludge production

In Table 6.1 relative quantities of sludge produced in the four systems are provided. Anorganic chemicals increase sweep coagulation and consequently sludge production. Polymers can weaken this process because they enhance stabilization and not sweep coagulation. Increased sludge production is the reason why chemical treatment has limited use in the U.S.A.. However, if lime is used as the coagulation agent, the sludge demonstrates some additional advantages. Because of its high lime-content and its high pH, the sludge is chemically "stabilized". It does not decompose rapidly and causes little odor problems.

5. Overflow rate

PT plants are designed to have an overflow rate of about 1,000 gpd/ft. Based on the average annual flow through the plant -this rate corresponds to the figures in Table 6.1. In Diagram 6.7 TSS and BOD percent removal, with and without chemical addition, versus overflow rate is shown for the plant in Sarnia, Ontario, Canada -the source of the APT figures in Table 6.1. The APT 80% TSS and the 57% BOD removal rates of Table 6.6 are achieved for overflow rates close to 2,800 gpd/ft², whereas for PT at the same overflow rate the performance would be around 30% TSS and 20% BOD. Moreover, the curves show that the performance in APT is less sensitive for daily or seasonal increases in overflow rate.

6. Comments on the data concerning removal rates

The relative improvement in performance between the four systems described in Table 6.1 and Diagram 6.6 can be summarized in Table 6.3 . In Table 6.4 the data of Table 6.2 have been analyzed in order to show relative improvement in performance between PT, APT, BST, and CS-2 systems. The results of the performance analysis will be presented at the end of the next section with relative cost differences.

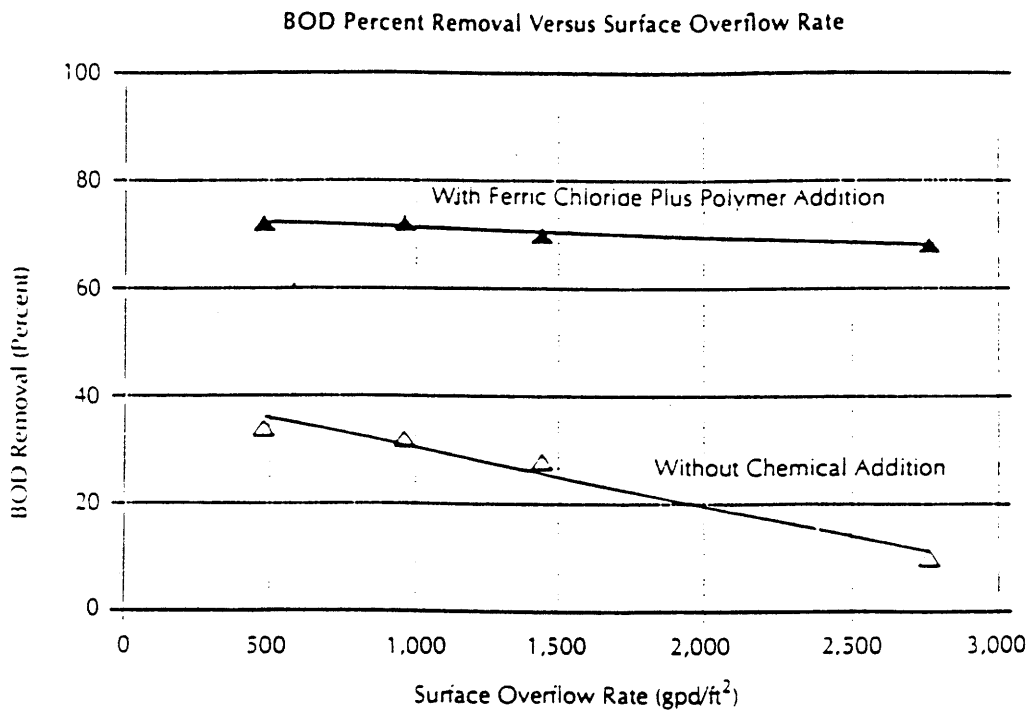
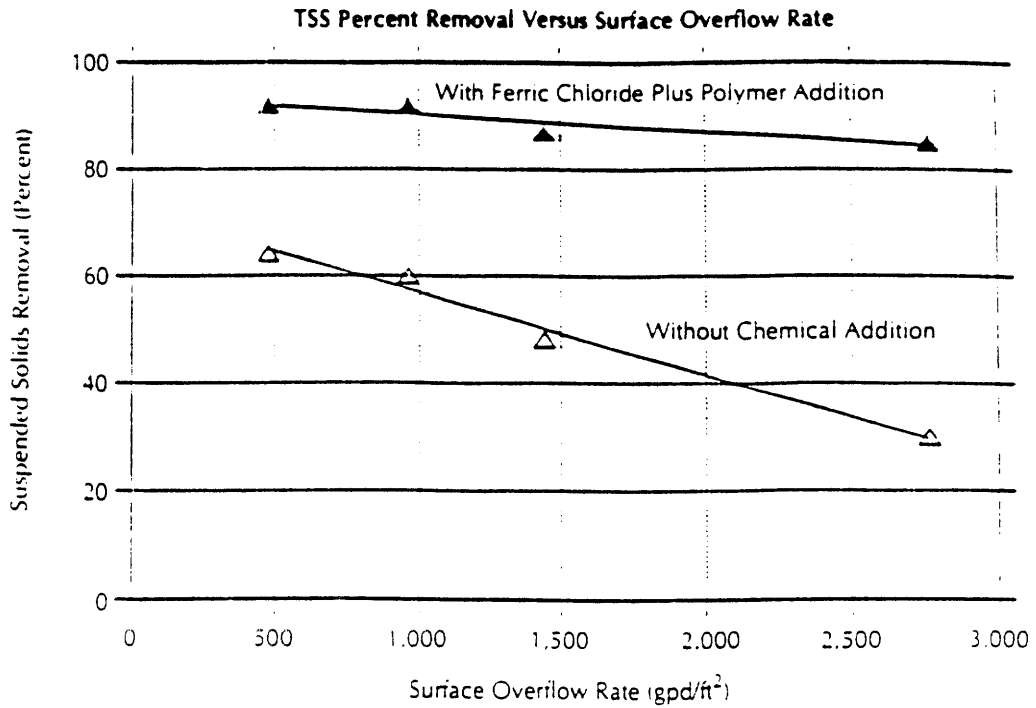


DIAGRAM 6.7 : TSS AND BOD REMOVAL RATES, WITH AND WITHOUT CHEMICAL ADDITION, FOR THE PLANT IN SARNIA, ONTARIO, CANADA

SOURCE: HARLEMAN et al., 1991, B

SYSTEM	PT	APT	BST	CS-1
<u>TSS REMOVAL RATE</u>				
APT	33%	-	-	-
BST	42%	6%	-	-
CS-1	52%	14%	7%	-
CS-2	65%	24%	16%	9%
<u>BOD REMOVAL RATE</u>				
APT	63%	-	-	-
BST	143%	49%	-	-
CS-1	129%	40%	-6%	-
CS-2	174%	68%	13%	20%
<u>P REMOVAL RATE</u>				
APT	325%	-	-	-
BST	50%	-65%	-	-
CS-1	375%	12%	217%	-
CS-2	?	?	?	?
<u>SLUDGE PRODUCED</u>				
APT	45%	-	-	-
BST	90%	31%	-	-
CS-1	100%	38%	5%	-
CS-2	?	?	?	?

TABLE 6.3 : RELATIVE INCREASE IN PERFORMANCE BETWEEN APT, BST, CS-1, AND CS-2 SYSTEMS

? : NO AVAILABLE DATA

SYSTEM	PT	APT	BST
<u>TSS REMOVAL RATE</u>			
APT	19%	-	-
BST	27%	7%	-
CS-2	27%	7%	0%
<u>BOD REMOVAL RATE</u>			
APT	48%	-	-
BST	88%	27%	-
CS-2	88%	27%	0%
<u>P REMOVAL RATE</u>			
APT	116%	-	-
BST	34%	-38%	-
CS-2	139%	11%	78%
<u>RAW SLUDGE PRODUCED</u>			
APT	54%	-	-
BST	100%	30%	-
CS-2	171%	76%	35%
<u>DIGESTED SLUDGE PRODUCED</u>			
APT	92%	-	-
BST	148%	29%	-
CS-2	252%	83%	42%

TABLE 6.4 : RELATIVE AVERAGE INCREASE IN PERFORMANCE BETWEEN APT, BST, AND CS-2 SYSTEMS BASED ON NATIONAL AVERAGES

6.4.2 Cost evaluation

The cost evaluation includes discussion of capital costs, operation and maintenance costs (O&M), and sludge treatment. In Table 6.5 data concerning national (U.S.A.) average capital and O&M costs, as estimated by expert engineers and quoted in Murcott, 1991, are presented. In Table 6.6 relative increases in cost between PT, APT, BST, and CS-2 systems are presented.

1. Capital costs

Capital costs consist of plant construction and equipment procurement²⁶ costs. One of the cost advantages of CS-2 compared to the similar BST is associated with the sizing of the secondary treatment. The BOD that remains after the APT phase is soluble since 80% of TSS including organic particles is removed during APT. The biochemical oxidation rate of the remaining BOD is about four times higher than the BOD that remains after the PT²⁷. This renders trickling filters a technically viable alternative to activated sludge secondary treatment. By comparing the volume requirements for trickling filters and an activated sludge aeration basin, it can be seen that for relatively low BOD strength the activated sludge method requires much more space (Table 6.7) [Harleman, 1990, B]. The cost consequence is that trickling and other filter methods are simpler, cost less, and require a smaller land area. Therefore, CS-2 system becomes highly attractive as an upgrade solution for existing PT plants. Another cost advantage of chemically enhanced methods comes from their ability to perform equally effectively at high overflow rates. This decreases the need for storage tunnels which are necessary in conventional plants when the maximum capacity of the treatment plant is exceeded.

2. O&M costs

O&M costs consist of equipment maintenance, labor, energy costs and chemical costs for

²⁶ In "2.2 O&M costs" the various systems are compared according to what specific equipment they require and to the level of the associated maintenance cost.

²⁷ The higher oxidation rate is due to the microorganisms' ability to oxidize smaller particles more easily than larger particles.

SYSTEM	CAPITAL COST (\$ / gpd)	O&M COST (\$ / MG)	TOTAL COST (\$ / MG)
PT	0.90 - 1.10	205 - 240	450 - 550
APT	1.10 - 1.40	230 - 280	550 - 680
BST	2.35 - 2.55	330 - 430	950 - 1,150
CS-2	2.35 - 2.55	320 - 410	930 - 1,130

TABLE 6.5 : NATIONAL (USA) AVERAGE TREATMENT COSTS

SOURCE: MURCOTT, 1991

CAPITAL		COST	
SYSTEM	PT	APT	BST
APT	25%		
BST	145%	96%	
CS-2	145%	96%	0%

O & M		COST	
SYSTEM	PT	APT	BST
APT	15%		
BST	71%	49%	
CS-2	64%	43%	-4%

TOTAL		COST	
SYSTEM	PT	APT	BST
APT	23%		
BST	110%	71%	
CS-2	106%	67%	-2%

TABLE 6.6 : RELATIVE COST-INCREASE OF SYSTEMS

S_o (mg/l)	AS Volume (1000 ft ³)	TF Volume (1000 ft ³)
160	269	780
140	235	530
120	202	290
100	168	150
80	134	60

TABLE 6.7 : COMPARISON OF VOLUME REQUIREMENTS FOR ACTIVATED SLUDGE AERATION BASINS AND TRICKLING FILTERS BASED ON BOD LOADING (S_o)

SOURCE: HARLEMAN, 1990,B

chemically enhanced systems.

a.) Equipment maintenance:

a1. APT and PT: The additional equipment required for APT compared to PT includes chemical feed systems (i.e. pumps, storage tanks, piping), which are easily maintained at a minimal cost.

a2. CS-1 and APT: The additional equipment required includes flocculation basins and mixing devices, which can be maintained at minimal additional cost.

a3. CS-2 and BST: A CS-2 system includes an initial phase of APT, whereas BST includes PT. Therefore, chemical feed systems, maintained at minimal additional costs, are required. The second phase of BST includes a secondary treatment method, usually activated sludge, whereas in CS-2 the much simpler, less expensive, and easier to maintain since trickling filter can be used as a secondary treatment method.

b.) Labor costs

The only treatment process significantly differentiated in complexity from the other ones examined, is the activated sludge method. Therefore, this method requires more skilled and better paid technicians.

c.) Energy costs

The largest amount of energy is consumed during the secondary treatment. Energy costs associated with PT and APT are minor compared to the costs associated with biological treatment. The amount of energy consumed is directly related to the BOD that has to be treated [Karlsson,1985]. A 40% decrease in BOD is equivalent to a 40% decrease in energy consumed. From Table 6.4, one can see that relative average increase in BOD removal between PT and APT is 48%. This means that, from the energy cost point of view, BST will be approximately 45% more expensive than CS-2.

d.) Chemical costs

It is generally believed that the high cost of chemicals has been one of the major causes that have kept chemically enhanced methods from general use. However, there are two arguments that weaken this statement. First, the use of polymers reduces significantly the

dosage of chemicals required. Second, the overall costs of a BST plant and of CS-2 plant have to be compared because the side cost advantages of the chemical methods may justify the high chemical costs. In Greece, lime, which is an effective chemical additive, is a very cheap and common building material. Additionally, in the coastal areas seawater exists in abundance and at no extra cost. Therefore, the combination of lime/seawater becomes a very attractive additive and the disadvantage of high chemical costs is weakened.

e.) Sludge treatment

It is generally believed that the costs associated with the treatment of the produced sludge are directly proportional to the amount of sludge generated during the treatment process [Mueller and Anderson, 1983]. Therefore, chemically enhanced treatment will be more expensive from the point of view of sludge treatment. The relative cost can be deducted from Table 6.1, where relative volume of sludge produced is shown. However, three arguments can be used to weaken this statement. First, the use of polymers decreases the dosage of chemicals and consequently the volume of sludge produced is decreased. Second, the concentration of chemicals in the produced sludge is beneficial for sludge digestion. Third, the use of lime/seawater produces sludge which settles and thickens well resulting in a more moderate sludge-volume production rate with special characteristics. Because it is chemically stabilized it does not decompose and causes little odor problems, therefore it can be stored and used later. For example, in Norway, where more lime is needed in the soil, the sludge is used in corn production areas after having been stored for some months.

3. Other cost advantages of chemically enhanced treatment

a.) Disinfection/ coastal and tourist areas

When lime is used as a chemical coagulant, almost complete disinfection occurs because of the high pH. Therefore, further treatment for disinfection purposes is eliminated, or has become much less expensive.

b.) Sludge reuse

High removal rates of P render sludge attractive as a land additive and soil conditioner. This may be an extra cash inflow for the corporation operating the plant.

c.) Sludge water reuse

High removal rates of N render sludge water attractive for irrigation purposes. This may also be an extra cash inflow for the corporation operating the plant.

6.4.3 Decision making considerations

The matching of the specific characteristics of coastal and tourist areas identified in section 6.2 with the advantages offered by chemically enhanced treatment is discussed in this section.

1. Flow variations

When chemicals are added, the overflow rate can be increased substantially without significant loss of performance. Tests in the South Essex Sewerage District, Salem have demonstrated a high ability to handle maximum storm water conditioning without deterioration in removal efficiencies [Harleman et al. 1991, A]. A similar concept can be applied for seasonal and daily variations. Therefore one can conclude that chemically enhanced systems can confront efficiently the problem caused by variation of flows in coastal and tourist areas.

2. Contaminant variation

The high TSS removal rates achieved in chemically enhanced systems help confront the contaminant variation problem because, as it has been discussed, contaminants such as metals, bacteria, viruses, and organic micropollutants are strongly associated with particles.

3. Limited disintegration in terms of particulate matter

The limited disintegration characteristic matches perfectly with the high TSS removal rates of chemically enhanced processes.

4. BOD removal rate

As it can be seen from Table 6.1 and Diagram 6.6 the BOD removal rates achieved in a chemically enhanced process are comparable, or better than the ones achieved in conventional processes.

5. Improvement of hygienic property

Since Hygienization of the wastewater is desirable when discharging to coastal waters, lime or lime/seawater is most suitable as a coagulant, due to the high coagulation pH (10.5-12) results in considerable disinfection.

6. Greece: most coastal areas face water shortage problems

The sludge water produced by chemically enhanced treatment has minimum concentrations of nitrogen, because of the higher removal rate and because the process does not produce additional nitrogen as do biological secondary methods. Thus, the water is usually suitable for irrigation reuse, or will require limited treatment in order to become suitable. The reuse of this water may help alleviate the water shortage problem in many areas.

7. Algal growth

Phosphorus and nitrogen stimulate algal growth. However, algal growth is usually undesirable for coastal tourist areas used as beaches. Moreover, subsequent algal decomposition provides a new source of BOD that tends to nullify the high BOD removal in the biological secondary treatment process. Therefore, chemically enhanced processes, which demonstrate high removal rates in P and N, are suitable for coastal and tourist areas [Ayoub et al., 1986].

In Table 6.8 the relative average cost and performance increase between PT, APT, BST, and CS-2 based on national averages is presented. There are two significant conclusions that can be drawn from the combined presentation:

1. APT appears to be a cost effective upgrade solution for existing PT plants. With an average 23% cost increase, the performance increase that is achieved is significant; 19% for TSS, 48% for BOD, and 116% for P removal rates. The only

SYSTEM	PT						APT						BST					
	TSS	BOD	P	R.SL.	D.SL.	\$/MG	TSS	BOD	P	R.SL.	D.SL.	\$/MG	TSS	BOD	P	R.SL.	D.SL.	\$/MG
APT	19%	48%	116%	54%	92%	23%												
BST	27%	88%	34%	100%	148%	110%	7%	27%	-38%	30%	29%	71%						
CS-2	27%	88%	139%	171%	252%	106%	7%	27%	11%	76%	83%	67%	0%	0%	78%	35%	42%	-2%

TSS : RELATIVE REMOVAL RATE
 BOD : RELATIVE REMOVAL RATE
 P : RELATIVE REMOVAL RATE
 \$: TOTAL COST
 R.SL.: RAW SLUDGE PRODUCED
 D.SL.: DIGESTED SLUDGE PRODUCED

TABLE 6.8 : RELATIVE AVERAGE COST-PERFORMANCE INCREASE BETWEEN PT, APT, BST, CS-2 BASED ON NATIONAL AVERAGES

disadvantage of the method is the increased sludge produced. The situation is improved if lime/seawater is used. In this case, less than the average volume of sludge is produced and the sludge is suitable for reuse. For Greece, the use of lime/seawater offers the additional advantage of lower than the average cost for chemicals required.

2. CS-2 is, on the average, more cost effective than BST while at the same time yielding higher P removal rate, which is a significant feature for coastal areas. However, this process yields increased sludge production. This problem can be ameliorated with the use of lime/seawater and the reuse of the sludge. As with APT, the use of lime/seawater in Greece offers the additional advantage of lower than the average cost for chemicals required.

The above analysis has demonstrated some significant advantages offered by chemically enhanced wastewater treatment technology for coastal and tourist municipalities, especially when the lime/seawater process is followed in Greece. A detailed feasibility study is now required so as to provide complete proof of the advantages described above on a mainly qualitative basis. The potential success of the research will offer an attractive solution to the wastewater treatment problem for Greece. First, it will provide a cost effective and easily implemented system offering enhanced performance compared to the currently implemented conventional systems. Second, as this will involve research and implementation of new technology, it will be eligible for financial support from EC development programs.

Chapter 7

THE STRATEGIC ROLE OF THE INDUSTRIAL DEVELOPMENT BANK OF GREECE

Chapter 7 is divided into two parts. First, a short description of the ETBA's experience as technical advisor, financial advisor, and fund manager is given so as to provide evidence of its potential capability to take a leading role in sewerage and wastewater treatment project realization. Second, a description of the proposed responsibilities and initiatives that ETBA intends to undertake and which constitute its leadership in the market is presented.

7.1 ETBA's Technical and Financial experience in infrastructure projects

7.1.1 Experience as Technical Advisor

ETBA is a pioneer in Greece on issues related to disposal and treatment of wastewater. It has realized, either through subsidiary firms or through its internal technical department, 200 km of sewerage network and six wastewater treatment plants. Four additional

treatment facilities are currently under construction in Industrial Areas²⁸.

The first wastewater treatment facilities were constructed in 1979 in the Industrial Areas of Patras and Thessaloniki and are operating successfully today. A synoptic description of the projects that constitute ETBA's technical experience is shown in Table 7.1. A significant point of interest is ETBA's experience during the operating phase, which may be unique in Greece; ETBA has had the responsibility not only of managing the financing and construction phases of the project but also to organize and control the operation.

ETBA believes that, through its experience with the Industrial Areas, it has obtained a deep understanding of the issues that govern the successful realization and operation of a wastewater treatment project:

- specific economic constraints
- advantages, disadvantages and cost of treatment technologies
- advanced thinking of issues concerning the efficient use of the treatment products such as the reuse of clean water for irrigation purposes (which is of high importance for many areas which suffer from drainage problems) and the use of sludge as manure in agriculture.

ETBA's qualifications are supported by a wide network of technical employees located all around Greece. Many of them have participated in the design, construction, and operation of the existing facilities. Their qualifications include an understanding of the Greek environmental and technical legislation, and construction market. Table 7.2 lists ETBA's technical employees as well as information about their specialization, experience and location.

²⁸ Industrial Areas are specific sites all around Greece, defined by Law, which are owned by ETBA and which are offered for industrial investment under very good economic terms. ETBA has the responsibility to negotiate the deals and provide the required infrastructure.

ETBA: TECHNICAL EXPERIENCE IN WASTEWATER TREATMENT PROJECTS

INDUSTRIAL AREA	YEAR	CAPACITY (CITIZENS)	VOLUME (M3/DAY)	AVRG TREATMENT (%)	COST (MIL.) [DRS.]
THES/NIKI	1984	80,000	10,000	90%	300
PATRA	1980	45,000	5,000	95%	250
IRAKLIO	1985	100,000	4,000	90%	450
KOMOTINI	1987	30,000	3,000	95%	300
DRAMA	1988	25,000	3,000	95%	300
KILKIS	1988	40,000	3,000	95%	350

FACILITIES UNDER CONSTRUCTION

LAMIA	1991	40,000	?	?	350
KOMOTINI	1991	35,000	?	?	150
PATRA	1991	85,000	?	?	300
THESSALONIKI (EXPANSION)	1991	100,000	?	?	200

Note: ^ All the facilities are secondary treatment facilities

? : No available data

TABLE 7.1 : ETBA: TECHNICAL EXPERIENCE IN WASTEWATER TREATMENT PROJECTS

SOURCE: ETBA: HUMAN RESOURCE DEPARTMENT

FULL - TIME EMPLOYEES

EXPERTISE	EXPERIENCE	LOCATION
CHEMIST	23	ATHENS
CHEMICAL ENGINEER	13	ATHENS
"- "	14	IRAKLIO
"- "	12	PATRA
"- "	12	KOMOTINI
"- "	5	KOMOTINI
ASSISTANT CHEMIST	12	DRAMA
CHEMIST TECHNICIAN	10	KILKIS
"- "	10	THESSALONIKI

PART - TIME EMPLOYEES

EXPERTISE	EXPERIENCE	LOCATION
CHEMICAL ENGINEER	21	THESSALONIKI
MECHANICAL/ELECTRICAL ENGINEER	14	ATHENS
MECHANICAL/ELECTRICAL ENGINEER	20	THESSALONIKI
MECHANICAL/ELECTRICAL ENGINEER	14	ATHENS
CIVIL ENGINEER	14	ATHENS
MECHANICAL TECHNICIAN	25	ATHENS

TABLE 7.2a : ETBA: TECHNICAL EMPLOYEES WITH EXPERIENCE IN WASTEWATER TREATMENT FACILITIES

SOURCE: ETBA: HUMAN RESOURCES DEPARTMENT

TABLE 7.2 : ETBA: TECHNICAL EMPLOYEES

FULL - TIME EMPLOYEES

EXPERTISE	ETBA	SUBSIDIARIES	TOTAL
CIVIL ENGINEERS	25	24	49
ARCHITECTS	4	2	6
MECH./ELECT. ENG.	11	5	16
ELECTRICAL ENG.	6	-	6
MECHANICAL ENG.	4	-	4
SURVEYORS	2	3	5
NAVAL ARCHITECT	2	-	2
CHEMISTS	4	-	4
CHEMICAL ENGINEERS	7	2	9
MINING ENGINEERS	1	-	1
ECONOMISTS ENG.	1	-	1
AGRICULTURALISTS	4	-	4
GEOLOGISTS	-	2	2
ELECTRONIC ENG.	2	-	2
ELECTR. TECHNICIANS	-	2	2
CIVIL TECHNICIANS	-	6	6
TOTAL			119

TABLE 7.2b : ETBA: TOTAL NUMBER OF TECHNICAL EMPLOYEES

SOURCE: ETBA: HUMAN RESOURCES DEPARTMENT

TABLE 7.2 : ETBA: TECHNICAL EMPLOYEES

7.1.2 Experience as Financial Advisor

ETBA has to demonstrate a long experience in the role of Financial Advisor, both for public sector and for private sector clients. According to ETBA's definition, the services offered by a Financial Advisor should include, the following:

- feasibility study, including alternative scenarios, for new projects
- planning, organization, and management of the financing of new and/or existing projects. Recognition and evaluation of alternative funding sources.
- design of the financial strategy program
- consulting during the financial deal structuring. Contract management and proper risk allocation, representing its client interests.
- identification of potential EC funding sources. Preparation of the required application material.
- management of EC funds on behalf of a public corporation to ensure efficient use and proper justification.
- negotiation of debt restructuring deals

The ETBA's diversified list of clients include:

- National Gas Company (DEPA) Natural Gas Pipe project
- Greek Shipbuilding Company S.A.
- National Oil Company S.A.
- Megalopoli and Ptolemaida municipalities: power plant projects
- Ministry of Industrial Development, Energy and Technology: feasibility study of alternative energy conservation projects

ETBA's role in the national gas project is described in the following paragraph. This project is one of the major infrastructure projects currently under development in Greece, both from a budget and a national significance point of view. It is a typical example of the role that ETBA intends to play in future sewage problems.

7.1.2.1 National Gas Company (DEPA): Natural Gas project

ETBA has been delegated the responsibility of Financial Advisor to the natural gas developing program by DEPA. The contract was signed in July 12, 1990. The program, which is the most significant energy project ever done in Greece, is scheduled to end in 2017 and has a total budget, in current values, of \$1,312.5 million.

ETBA's responsibilities in the first phase of the project include:

- evaluation of the currently completed studies, which define the scope and the horizon of the project
- definition of the financial characteristics and constraints of the specific project
- evaluation and proposal of cash-flow models, under alternative economic, political, and technology scenarios
- preliminary research of potential funding sources and evaluation of each source's string clauses
- submission of a Special Report, in which the initial structure will be evaluated, and alternative structures will be described, mentioning advantages and disadvantages.

ETBA's responsibilities in the second phase of the project include:

- general consulting services on debt structuring strategy
- submission, presentation, and defense of financing application to potential lenders on behalf of DEPA
- consulting services during the negotiation of the deal and the preparation of contracts
- debt-contract management on behalf of DEPA

ETBA, in order to better satisfy its customer's needs and to acquire experience, took advantage of its international credibility and reached an agreement with Citicorp, London.

Citicorp will be ETBA's "advisor" for the specific project.

7.1.3 Experience as Fund Manager

ETBA has to demonstrate a long experience in fund raising, both in domestic and international markets. ETBA is cooperating with a network of international banks, and financial institutions in Greece, Europe, USA and Japan. In 1990, ETBA was the largest underwriter in Greece, of both bonds and new stocks issues.

In infrastructure, ETBA has raised funds for all transportation and environmental projects required to Industrial Areas. Currently ETBA is participating as an underwriter and managing bank, in the scheduled "Attiki Road" bond issue. The "Attiki Road" is the largest highway project around Athens, whose completion is related to the solution of the air-pollution problem, and to the successful operation of the new Athens International Airport. In the next paragraph the responsibilities undertaken by ETBA in this project are described, as a typical example.

7.1.3.1 Bond Issue for the "Attiki Road"

The Special Fund for Urban Planning (SFUP), a public organization under the control of the Ministry of Public Works and Environment, which is responsible for the realization of the new highway "Attiki Road" has decided to finance it through a 20,000,000 drachmas bond issue.

ETBA has been assigned the role of Underwriter and Managing Bank. As an Underwriter ETBA has the obligation to buy all the bonds that are not sold. As a Managing Bank, ETBA, through its local representatives or cooperating banks, will make interest payments each year and fund capital return at the expiration date. The basic characteristics

of the bond issue are described in Table 7.3.

7.1.4 Experience in Program Contracts

ETBA is currently attempting to implement a Program Contract structure for the case of the municipality of Tripoli²⁹. This structure closely simulates what is going to be proposed as a general strategy in section 7.2. Its implementation in Tripoli was more a coincidence than a clear strategy.

7.1.4.1 Program Contract for the Municipality of Tripoli

ETBA was planning to construct and operate a wastewater treatment facility for the Industrial Area located near Tripoli. At the same time, the Mayor of Tripoli wanted to construct a similar facility for his municipality. When he failed to raise all the required funding, he proposed³⁰ ETBA construct a larger facility in the Industrial Area, so that Tripoli could be also serviced. The peculiarity of this agreement is that ETBA and the municipality will be co-owners of the facility. This means that for the first time a municipality will own a facility of an Industrial Area, and for the first time ETBA will own a facility of a municipality. However, nobody could deny that under this "innovation-by-chance" scheme, economies of scale would be achieved.

The projects included in the Program Contract, and the responsibilities of each participating party are:

²⁹ Tripoli is one of the largest municipalities in Peloponnissos, in the south of Greece. Population: approximately 40,000 people.

³⁰ If one wanted to investigate the politics of this case, he would find that the mayor forced ETBA to agree by threatening it that Tripoli's citizens would otherwise create problems to the proper functioning of the Industrial Area.

TERMS OF "ATTIKI ROAD" BOND

A. GENERAL TERMS

<u>1. ISSUER</u>	Special Fund for Urban Plannin
<u>2. CONTROLLER</u>	Ministry of Public Works and Environment
<u>3. LOAN CAPITAL</u>	20,000,000,000 drachmas
<u>4. DURATION</u>	5 years
<u>5. GUARANTEE</u>	Guarantee of the Greek government
<u>6. UNDERWRITTER</u>	Industrial Development Bank of Greece
<u>7. MANAGING BANK</u>	Industrial Development Bank of Greece
<u>8. LOAN PURPOSE</u>	The financing of the 1st part of the construction of Attiki Road

B. CHARACTERISTICS OF THE BONDS

<u>1. NAME</u>	Attiki Road Bond
<u>2. PRICE</u>	Nominal Value
<u>3. INTEREST</u>	Floating, 0.5% over the last interest payment of Treasury Bonds. For the first year the interest will be fixed and equal to 24% annual.
<u>4. CAPITAL RETURN</u>	The expiration date
<u>5. PAYMENTS</u>	5 annual oayments
<u>6. PAYMENT LOCATION</u>	ETBA' s local representatives
<u>7. TAXATION</u>	The interest payments are tax-exempt

TABLE 7.3 : "ATTIKI ROAD" BOND ISSUE

SOURCE: SPECIAL FUND FOR URBAN PLANNING: FINANCIAL DEPARTMENT

1. Projects:

- a) wastewater treatment for the Industrial Area and the municipality of Tripoli
- b) sewerage network connecting the current municipality network with the wastewater treatment facility

2. Owner of the Projects:

- a) 55% RCWSS of Tripoli
- b) 45% ETBA

3. RCWSS' responsibilities:

- a) issuance of the required construction and operating permits
- b) foundation of the operating corporation
- c) collection of user fees
- d) 55% contribution to the total project cost

4. ETBA's responsibilities:

- a) As a Technical Advisor
 - a1) technical consulting and control during the design phase
 - a2) project management/bidding
 - a3) technical support during the operating phase
- b) As a Financial Advisor
 - b1) financial management of the project
 - b2) identification and procurement of potential EC funding sources
 - b3) management consultant for the operating corporation
- c) As a Fund Manager
 - c1) negotiation and organization of the debt contracts
 - c2) participation in the funding package
- d) As a Co-Owner
 - d1) 45% contribution to the total project cost
 - d2) site expropriation

Remark: ETBA is going to satisfy some of its responsibilities through its internal

departments, some through its subsidiaries, and the majority through contracts with the private sector.

ETBA will receive a lump sum fee for its services during the design and construction phases. For the rest of the services it will receive a fee calculated as a percentage of the total project cost.

7.2 ETBA's strategic role

ETBA, taking advantage of

- its eligibility to sign Program Contracts with municipalities and municipal corporations, and
- its technical and financial experience in sewerage and wastewater treatment projects,

intends to take initiatives as Technical Advisor, and/or Financial Advisor, and/or Fund Manager for sewerage and wastewater treatment projects and for clients mainly belonging to the public sector, municipalities, and municipal corporations.

The qualifications which permit ETBA to play the intended role are summarized as:

- its knowledge of the domestic and international financial markets, and of the EC funding mechanisms
- its property of typically being a public corporation, which allows it to exploit all the legal advantages generated by its public character. At the same time, it has the freedom to function under private banking criteria thereby avoiding the bureaucratic characteristics of the public sector,
- its development character and its experience in planning, controlling and realizing development projects,

- its existing network of technical and financial employees located all around Greece, which gives it a better and immediate understanding of local needs, problems, and market,
- its long experience in planning, financing, constructing, and operating sewerage and wastewater treatment projects.

As Advisor of the Owner of the project ETBA intends to participate at all project phases,

- Phase 1. : Planning and feasibility study,
- Phase 2. : Design,
- Phase 3. : Construction,
- Phase 4. : Operation.

The responsibilities of the Technical Advisor of an infrastructure project, as perceived by ETBA include:

- Phase 1. Definition of the required level of treatment; selection of the appropriate technology; statement of governing parameters of the project design based on the budget limits, on seasonal variance of needs, and on forecasted trend of population increase; and, identification of potential economies of scale that can be achieved by promoting cooperative projects between neighboring municipalities.
- Phase 2. Support and control for the completion of the design; study for potential reuse of the treatment products (i.e. sludge as fertilizer, water for irrigation); preparation of the Request For Qualification; and control of the procedures followed for the selection of the contractor and for the selection of the required equipment.
- Phase 3. Schedule control; cash-flow control; control of the project delivery procedures; equipment testing; and experimental operation of the facility.
- Phase 4. Management of the personnel selection and training procedures; preparation of the operation regulations; and management of special occasions.

In short, ETBA will play the role of a technically intellectual owner in the private sector, for the technical issues of the project. Under this structure, ETBA will not be restricted to follow the bureaucratic legal procedures of a public sector construction project. It will have the flexibility to adopt innovative project delivery methods and implement innovative technologies. It will contract out to the private sector most of its responsibilities and keep for its departments those that it considers crucial for the project's successful completion and those that it can better perform in-home. ETBA will also be eligible to contract out the operation of the facility to a private contractor, whom it will supervise for the period defined by the Program Contract.

The **responsibilities of the Financial Advisor** of a sewerage and/or wastewater treatment project, as perceived by ETBA include:

- promotion of economies of scale through the identification and proposal of cooperative projects. Due to the complete segmentation of the municipalities authorities the evaluation of potential cooperations between neighboring municipalities so as to satisfy their basic infrastructure needs is required. At the same time an evaluation of their needs with development criteria is also required. Under the existing circumstances, the majority of the municipalities cannot promote and implement an organized infrastructure policy due to their small population, their financial sources shortage, and their lack of basic organization.
- the objective evaluation of the financial needs of the project. This includes the calculation of expected preconstruction expenses, estimate of operating expenses and revenues, and creation of cash-flow models under alternative scenarios.
- identification, evaluation, and proposal of potential financial sources.
- particular interest in the exploitation of the EC financing opportunities. The emphasis will be on the maximum absorption of available EC funds and on their efficient use. ETBA's long cooperation with all EC financing departments probably renders it the most appropriate public corporation to be delegated the

- responsibility of the management of EC funds.
- representation of the owner during the negotiation of contracts (i.e. debt contracts, construction contractors).
 - calculation of a final cash-flow model after the all the contracts are signed. This includes discussion of the pricing policy of the facility and presentation of alternative potential policies.
 - supervision of the rate of fund withdrawal and rational investment of surplus capital during the construction and operation.
 - financial organization of the operating corporation.

In short, ETBA will play the role of a financially intellectual owner of the private sector, for the financial issues of the project. The time horizon of its services will expand in all four project phases and for the duration defined by the Program Contract. The services of a Financial Advisor are more generally described for all infrastructure projects in section 4.5.1 .

ETBA's fee for its services as Financial Advisor of the owner, will be the sum of:

- General Expenses (i.e. transportation, legal), which will be variable and dependent on the needs and progress of the specific project.
- Management Fee, which will be a negotiable fixed percentage of the total project cost.

ETBA's participation in the financial package of a project will be done according to business criteria and not according to a social policy logic. The inspections that ETBA is going to establish before it accepts its role as a Fund Manager for a sewerage and/or wastewater treatment project are the following:

- examine the current debt obligations of the RCWSS and of the municipality it serves. Evaluate the feasibility of the repayment schedule they propose for these

- obligations. Investigate their behavior in previous agreements to verify credibility.
- evaluate the financing and cash-flow models constructed. Define whether the planned facility will be technically and financially competent for the time horizon proposed.
 - evaluate the stage design and pre-construction phases, so as to define when the construction can really start.
 - evaluate the ability of the proposed project team structure to complete the project within budget and on schedule.
 - evaluate whether the remaining capital required for the project completion will be available when and the quantities needed.
 - evaluate the experience and the technical qualifications of the personnel that will support the operating corporation.
 - estimate the provisions for the operating and maintenance costs. The total amount should include logical but conservative forecasts for inflation and the cost of labor.
 - evaluate the forecasts made concerning the increase, or decrease in the number of consumers during the debt period.
 - evaluate the sanctions provisioned for the collection of user fees, and the guarantees that the revenues are going to be used only for the needs of the corporation and not for irrelevant municipality needs.
 - ensure that the method followed for the calculation of the user fees, gives a price which
 - provides adequate revenues for operating expenses and debt repayment, and
 - is not too high to hinder acceptance by consumers.

At the same time a mechanism which would ensure adjustment of the user fees in case of abrupt change in inflation, legislation, or force majeure.

- ensure that the operating corporation will periodically publish a "Special Consumer Report", in which the all consumers will find the financial results of the

last period and totals for the current accounting year. An inspection of these results will be done regularly by ETBA during the debt repayment period.

ETBA intends by taking responsibilities of a Fund Manager to accomplish the following goals:

- exploit its international credibility, get competitively priced loans, and then offer them under competitive prices for sewerage and wastewater treatment projects (back-to-back loans). The cost of these loans will be lower than what the facility owners would get on the open market. ETBA's profit will come from the spread between the two interest rates.
- provide letters of credit to the facility owners. In cases where ETBA also acts as a Financial Advisor, it will be easier for it to provide such letters of credit.

In short, ETBA will play the role of a banker-owner of the private sector, for the funding needs of the project. ETBA will be delegated total responsibility and freedom of action in order to raise the needed funds under better economic terms and according to the project scope. The time horizon of its services will expand in all four project phases and for the duration defined by the Program Contract. Its role will be that of a Project Lender (or Intermediator) and the related services are more generally described for all infrastructure projects in section 4.5.1 . Under, this structure ETBA is allowed to contract out part or all of its responsibilities.

In case the signed Program Contract delegates to ETBA the triple role, ETBA will have complete responsibility of the project realization during all four phases. The main issues that need to be discussed about this structure are:

- ETBA will have the flexibility during the planning period to evaluate whether economies of scale are present in the specific area. This means that ETBA will investigate whether the specific project may become more economically attractive

- if it serves more than one neighboring areas. If this is the case, it can negotiate a similar arrangement with the other municipalities.
- ETBA can contract out most parts of the project following private sector business procedures. Private developers will be urged to participate in the project realization or even take equity positions for a certain period. Project finance approaches under innovative contractual arrangements (i.e. BOT) will then become an eligible solution.
 - the new project structure is a hybrid between the old central control system and privatization. Although it reduces the level of explicit central government and municipality control in the implementation process, it gives the authority for this control to a public corporation. The difference is that ETBA is no longer subject to all the bureaucratic procedures and restrictions.

Chapter 8

CONCLUSION

The analysis of the existing project financing and organizational structure has demonstrated some significant deficiencies and malfunctions. The most significant ones are:

- * Inefficient spending: During the last ten years a significant amount of funds originating both from governmental and EC sources, have been given to municipalities for the construction and operation of wastewater treatment projects. However, few projects have been completed, and even fewer are successfully operating without requiring periodic financial contributions from the government.
- * Shortage of new government funds: The Public Development Account, the State Budget, and the Deposits and Loans Fund can no longer afford to provide funds to municipalities for new projects. Their constrained resources do not even allow for funding the completion of the projects which are currently under construction and expect continued funding. The Minister of Internal Affairs does not have funds available for operating completed facilities when municipal fees do not cover operating expenses.
- * Unused or improperly used EC funds: The EC development programs for southern Europe, and especially those for the preservation of the Mediterranean Sea, offer a significant amount of financial resources for wastewater treatment projects. The available funds for Greece are sufficient to finance all the projects that are currently required in coastal areas. Therefore, project selection procedures are

required; just a complete and justified application. However, due to improper application or ignorance, the percentage of available EC funds actually taken by Greece is below 50%. Even worse, a significant part of the funds received by Greece is spent for operating expenses of the municipalities instead of intended projects.

- * Bureaucracy and Centralization: The existing bureaucratic and centrally governed structure of organizing and financing wastewater treatment projects does not allow close control of the way municipalities invest the funds they receive. This is an example of the observation that the Greek economic and political system resembles to, and brings all the disadvantages of, a western version of an eastern system.
- * Total Absence of Private Sector: Under the existing organizational structure the private sector is prohibited from contributing to the realization of wastewater treatment projects. Therefore, in a small country like Greece, significant financial, managerial, and technical resources are restricted from the project realization process.

The analysis of the legislative and organizational system governing the process of wastewater treatment project realization in Greece has shown that a solution to the above problems exists and does not require time-consuming legislation changes. Municipalities are allowed to sign Program Contracts with specific government owned corporations. Under the contract the corporations undertake the roles of Financial Advisor, Technical Advisor, and Fund Manager, or any combination, and can contract out the project, in part or in whole, to the private sector creating some sort of public/private partnerships. Their government ownership makes them eligible to apply for and manage funds from environmental development programs. Their corporate structure together with the participating private sector allow for hope that a more efficient use of the available financial resources will be achieved. Under this scenario, professional engineers and

financiers will manage the resource allocation, whereas, under the existing scenario, mayors who are elected for a short period and who many times do not have any education or experience in project realization, have to manage all the funds. The experience of organizing and financing wastewater treatment projects in Greece tells that they have failed.

The Industrial Development Bank of Greece (ETBA) is the first government owned corporation to demonstrate interest in signing Program Contracts for wastewater treatment projects. Its successful technical, financial and managerial experience in similar projects proves that it has the required credentials to successfully undertake the new triple role. Another significant point is that ETBA is the Greek State Development Bank and as such it needs to broaden its activities and adapt them to future needs.

One of the main concerns during the study has been to investigate whether a new more efficient wastewater treatment technology can be implemented in Greek coastal municipalities. Experimentation on new technology means more EC financial backing and potential success means money saved for Greece. The attention has been drawn to chemically enhanced technology, which has been implemented in Norway, in some plants in California and Canada, and is being tested in Salem, Mass.. The method gives very good results for coastal areas and areas with variance in demand. It is also very effective for the removal of P and N, which are two crucial pollutants for coastal areas. Finally, it seems to be very attractive as an upgrade solution to existing primary treatment plants.

Chemically enhanced treatment was first discussed and tested during the late 1930's. However, it has never been extensively adopted except in Norway. The method returned to the forefront during the end of the last decade resulting in extensive experimentation. The supporters of the method say that it has not been used extensively earlier for three reasons. First, because of chemicals cost, which used to be much more expensive. Second,

because of the large sludge quantities produced. Third, because the conventional technology, though not the most efficient, has satisfactory performance and so no motivation existed to experiment on something new as long as funds were not a major constraint for the public sector.

In Norway, chemically enhanced treatment has become "conventional" in the place of conventional technology. The experiments in the United States have produced some very promising performance results. However, no adequate data concerning all the capital, operating, sludge treatment related costs of the new technology are available. Therefore no quantitative cost-benefit analysis can be done. The cost comparisons that exist are based on qualitative judgements of "experts" and not exact field data. In Boston, where the method has been proposed for the new plant on Deer Island, the state has provided funds for a one year additional tests before the final decision is made. The results will be critical for the future of the method, since a potential implementation of the method to the Boston Harbor project will attract the attention of more owners/states and engineers. It is the perfect opportunity for cost analysis because until now, as it is the case in Salem, engineers have been more interested in the technical and chemical aspects of the method.

All the available information shows that the method has a great potential. A study of the literature has shown that the method appears to be a better solution for coastal areas. In the Greek case, a coincidence offers even greater advantages: the combination of seawater and lime is a very effective chemical additive. The cost of both is minimal in Greece; seawater only needs to be pumped and lime is a very cheap building material. Thus, the high chemical costs disadvantage is no longer present. Other major advantages of the lime/seawater process are that it produces significantly less sludge, that the sludge produced can be stored for a longer period, and that the high pH of the discharged water results in considerable disinfection. Disinfection is a key parameter for coastal tourist areas. Finally, this process can perfectly match the need of the small and medium size

coastal municipalities in Greece, which require a treatment plant able to satisfy both their low winter demand and their high summer demand.

8.1 Recommendations

Two major lessons have been learned from this thesis. First, the existing financing and organizational system cannot meet the needs of the '90s, and cannot help Greece meet the standards of the forthcoming integrated European Community. However, there are alternatives if government leaders are willing to accept them and implement them with the cost of losing some of their centralized power. No solution can be reached unless decentralization, flexibility, and room for innovation are provided for the system. This can be achieved only if the private sector is allowed to take part of the responsibility and initiative. Second, the analysis of the specific needs of coastal and tourist municipalities has shown that the currently adopted conventional technology is not the most efficient solution for the Greek coastal municipalities. Maybe part of the financial problems of existing plants are caused by the fact that they are oversized in order to satisfy the summer peak demand. The chemically enhanced treatment is a potential solution and deserves further research in order to be supported by exact and detailed cost data.

The Government should consider the proposed framework and take the following initiatives:

- * Abandon the strategy of offering free -without guarantees- money to municipal mayors and implicitly oblige them to look for new financial sources. Present to them the opportunities offered by EC and how ETBA can service their project needs. Municipal councils should separate election campaigns and operating expenses from funds for infrastructure investments.
- * Promote ETBA's participation and support its initiative in the European

Committee. ETBA's case can be initially used as an experiment for a further participation of other government owned corporations not only in wastewater treatment projects but also in other municipal infrastructure projects.

- * Offer tax and other financial incentives to private corporations in order to attract their interest in the construction and operation of wastewater treatment projects.
- * Support a marketing campaign to raise the interest of citizens in environmental projects. Expand this education beyond identification of current problems to include possible solutions.
- * Support a marketing campaign to educate the citizens of the municipalities so that they understand that there is nothing bad if the private sector undertakes projects which are traditionally considered public.

ETBA should continue its effort through specific initiatives:

- * Create an internal team of engineers, financiers and managers and delegate them the responsibility to find ways to promote the plan to municipal authorities. Present the current situation and demonstrate the advantages of the proposed structure. Approach private developers and urge them to participate in the project realization and/or take equity position. The first group of approached should be private investors whose interests are connected with the environmental protection of each area, such as tourist facilities owners.
- * Construct and operate an experimental treatment plant in which both conventional and chemically enhanced technology -using lime/seawater process- will be implemented. At the same time Greek environmental engineers should be introduced to the method and asked to contribute to the success of the experiment. For this project funds will be raised through an environmental technology EC program. The performance and cost data from this plant will serve to justify the potential benefits from extended implementation of the new technology. It is obvious that this project will be of high priority.

- * Create a team of employees and provide them with training on the financing mechanisms of EC. They will be the ones who will have the contacts with the European Committee and EIB, who will propose the most appropriate financial source for each project, and who will consult the municipalities while preparing the applications for the funds.

ETBA, under the proposed structure, is faced with a unique opportunity to justify its role as the Greek State Development Bank. The new project structure is an hybrid between the old centrally controlled system and privatization. Although it reduces the level of explicit central government and municipality control during the implementation process, it gives the authority for this control to ETBA. ETBA is no longer subject to all the bureaucratic procedures and restrictions of the old system and has a much higher level of flexibility to act. This difference is its key advantage.

The current period is of great importance for the future of Greece. Along with all the other economic changes which are in progress, the environment and the way that it is protected should be of primary importance. Clean sea is a key asset for the Greek economy and must be preserved. Therefore the methods followed for the realization of projects related to environmental protection should be reviewed and improved. New financial, organizational and technology strategies need to be implemented to meet this goal.

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