through the introduction and implementation of the programs under the Concept II.

9.3.2 Recommended Institutional Programs under the Concept I

The following programs are recommendable to solve the current problems. These programs are proposed to be implemented, covering the whole State. Detail contents are given in Chapter 10 of the Main Report I.

<Program 1 Organizational Strengthening through Implementation of the Current Re-organization>

After the analysis of the required tasks, adequate staff allocation, examination of required budget and the consequent appropriation would be necessary. Re-organization of the branch offices should follow, coupled with training and re-training, especially for the transferred staff and the staff in charge of field or extension services with elaborated instructions and manuals.

<Program 2 Strengthened Groundwater Management>

Potential assessment of the groundwater, applying the methodology shown in the Study, is recommended as the first necessity. Strengthened inspection of water use and promotion of registration would be necessary through organizing a team for the duty. Registration or licensing the professional drillers and a system to control of them are recommendable. Establishment of a procedure for granting groundwater development is recommended. Regulations of surface water conservation through land use control in catchment areas of the source of public supply would better be applied to recharging areas of the aquifers as well.

<Program 3 Enhancement in the Enforcement of Environmental Regulations>

The following five sub-programs are recommended.

1) establishment and enforcement of reporting obligation of operation and accidents by water user to the competent entity
2) effluent standards by scale and by type of industry
3) phased enhancement of detecting capability of problems and inconformity to the effluent and the water quality standards
4) prohibition of effluent infiltration to the ground.
5) enhanced control of agrotoxic use

Establishment of a regulation on the obligations to monitor effluent and to report by industries themselves are recommended, so that pollution control could be more efficient if the regulation is enforced adequately. Strict enforcement of the effluent standards requires examination of availability of treatment technology of the industries. Effluent standards by scale and by type of industries might be necessary. With the limited capability of the responsible entity, nomination of harmful substances out of those designated in the effluent and the water quality standards for continuous monitoring activities would be required after investigation and examination of conditions of industrial and agricultural production as well as the magnitude of harmful effects caused by the items designated in the effluent and the water quality standards. Guidance for appropriate use of agrotoxic use to the farmers and encouragement of coordinated use among neighboring farmers are recommended.

<Program 4 Legal Arrangement for the Control of Soil, Sand and Stone Taking in River Areas>

Some granting procedures for soil, sand and stones taking in river areas are recommendable in order to maintain normal functioning of water courses including flood control.

<Program 5 Cost Recovery of Water Environment Management>

(1) Cost Recovery of Resources Assessment and Environmental Monitoring

Fee charging according to the volume of water granted is recommended not only for demand control but also supplemental funds for resource assessment and environmental monitoring activities.

(2) Cost Recovery of Water Supply and Sanitation

Continuous revision of tariff tables is recommended based on long run marginal cost (LRMC) pricing and progressive block tariff to achieve the cost recovery, equitable demand control and optimal investment. In order to reduce 40% of the current leakage, leak detection by organizing an inspection team would be recommendable for cost saving of water supply services.

<Program 6 Promotion of Residents Participation through Information Publication>

Periodical publication of report on data collected and analyzed, current issues, and government policies would contribute to public awareness and to encourage residents' participation to water environment management.

9.3.3 Recommended Institutional Programs under the Concept II

<Program 7 Introduction River Basin Management and Establishment of Competent Entities>

River basin management, a management of river basin as a unit of water resources management, has been found equitable and efficient for comprehensive water resources management. Besides, the Constitution, 1988, has the clear definition of ownership of water by river and hydraulic energy potential in all rivers, which might not accord to river basin management. As stipulated in the Constitution, the Federal Republic has the exclusive power to legislate on waters, energy and the regime of lake or river navigation. The policy, the instruments to achieve the policy, the system and the organization of river basin management must be discussed, enacted and enforced within the legal frame of the federal administration. The participation of the State to the river basin management for preservation of its property, environmental conservation, registry and control of concession of water use in its domain shall be carried out within the policy frame of the federal legislation.

(1) Establishment of the Competent Entity

Hydrographic characteristics of the Tibagi River Basin, to be noted for organizing river basin management, can be summarized as described below. The competency of the river management entity, such as a Basin Committee (Sub-basin Committee) and a Basin Agency (Sub-basin Agency), could be proposed as the following two options.

1) All rivers in the Tibagi River Basins finally belong to the Paraná River Basin, and form a complicated hierarchy of flow system (according to the current discussion on river basin management at the federal level, the Tibagi River Basin is classified as a sub-basin of the Paranapanema River Basin, which is a sub-basin of theParaná River Basin)

2) All rivers in the Tibagi River Basin are state rivers, whose water is the property of the State, except hydraulic energy potential.

<Option A>

The most common type of inter-jurisdictional basin entities, in the federative system, is a committee with functions to coordinate basin planning, operation and regulatory activities of the political jurisdictions, or to issue some guidelines or recommendation to be approved and followed by the jurisdictions. These committees are governed by high officials from the affected jurisdictions, forming board of directors, with some participation of users and other stakeholders, while staff assigned by the jurisdictions conduct day-to-day work.

In this option, basin agencies are not necessary to be established. In the case that a multi-purpose facility development is found efficient for water use, conservation or flood control, some joint venture agency can be organized for planning, design, construction, operation and maintenance of the facilities, with shareholdings by jurisdictions, public agencies or utility companies under the supervision of competent entities assigned by jurisdictions.

<Option B>

Recommended structure and competency Basin Committees (Sub-basin Committees) and Basin Agencies (Sub-basin Agency) in Option B are illustrated in Figure-9.2.

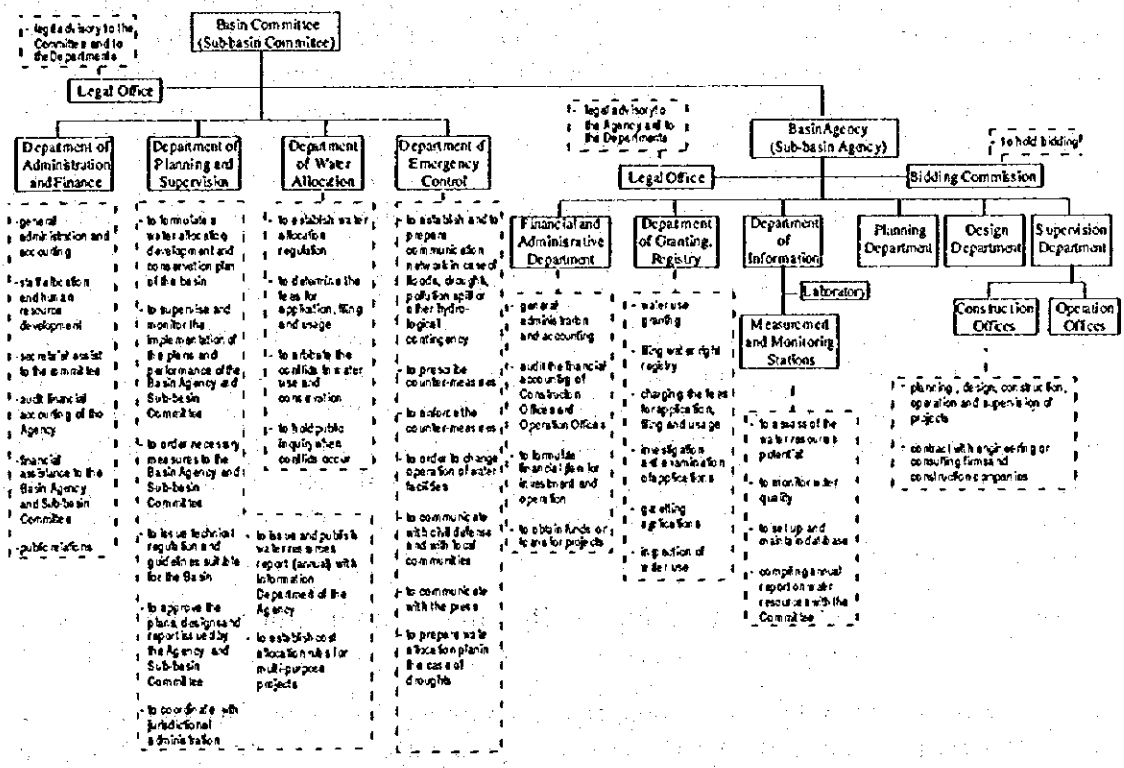

Figure-9.2 Recommended Organization Structure and Competency of Basin Management Entities (Option B)

Option A can be recommendable under the current legal frame, while in order to achieve the principles to respond to the future needs, or to attain optimal management, water allocation and development as well as the resources conservation should be comprehensively planned, appraised, implemented and monitored. Scope of the competency of the basin management entities should be wider and stronger as described as Option B.

The Tibagi River Basin is favored with rather simple jurisdictional involvement, compared to the Iguaçu River Basin. In the case that hydro-power management can be combined into the river basin management, Option B could be legally feasible. Participatory management could be attained so that equitable river basin management could be achieved, supported by sufficient awareness of the riparian Municipalities on water environment management. Even though hydro-power management is attributed to the Federal Republic, the ELETROSUL and the COPEL have increased concern on environmental protection, coupled with intensive research and studies conducted by the ELETROBRÁS. Some form of river basin management emphasizing the natural resources conservation could be established, where preventive conservation can be achieved, coupled with the programs.

<Program 8 Promotion of Coordination for Comprehensive Management>

(1) Establishment of an "Inter-sectoral Committee"

Water resources allocation, development and conservation should be conducted harmoniously as measures to attain the objectives of the socio-economic development plan and sector development plans. Before the formulation of water environment management policy, information exchange on each sectoral development plan is necessary, so that the policy can serve an instrument of optimal socio-economic development.

An "State Inter-sectoral Committee" attended by high officials, chaired by the General Director of the State Secretariat of Planning and General Coordination (SEPL) and attended by high officials of the relevant State Secretariats, Public Agencies and other relevant entities, and a few "Sub-committees", such as on development policy formulation, water pricing and tariff revision, whose subjects would be designated by the Committee, attended by the officials of Director level of the relevant sector, might be recommendable. "Working-group" activities by middle management level or group studies might also be encouraged.

(2) Further Close Coordination with Land Use Management

Water environment administration and management have linkages with regional development and consequent changes in land uses. Water supply and sanitation programs should cover the urban expansion. Development of flood prone areas would necessitate flood plain management and flood control. Water quality conservation at the sources for public supply would require land use restriction or control, as currently enforced. Hydrological potential would be a tight constraint for city planning. More close coordination with the SEDU should be promoted.

<Program 9 Establishment of Public Hearing System into the Water Use Granting Procedure>

Currently before the water use granting, gazetting procedure is due, lacking consequent procedure for notification of objections to the application by prospectively affected parties and adjusting system upon which the discretion of the public entity or the Basin Committee

can be made. Preliminary adjustment before the granting through the procedure recommended would prevent conflict among individuals. A model of the procedure is discussed in the Sectoral Report Vol. M, Institution.

<Program 10 Comprehensive Water Quality Management by River Basin>

(1) Effluent Standards by River Basin

The objective of the effluent standards can be regarded as the achievement of the water quality standards of the basin to meet the minimum environmental requirements of the society along the Basin. In this sense, the effluent standards can be set for each basin, examining the current and prospective total volume of effluent along the river, as well as the diluting and self-cleaning capacity of the basin. Some stricter effluent standards may be necessary to be drafted by the SEMA or the Basin Committee and discussed in the State Environmental Council and established through legislative process. The capability of the SUCEAM, or the Tibagi Sub-basin Agency, for research and development of effluent treatment technology, and for guiding and supervising industries should be much strengthened for the implementation of the plans for the reduction of total pollution loads.

(2) Introduction of Sewerage Scheme and Management by a River Basin

Conventionally, sewerage systems are constructed and managed for the improvement of sanitary conditions of municipal areas. With the expansion of urban areas and growing pollution loads from the treatment facilities to rivers, sewerage schemes should be programmed in the viewpoint of the water quality conservation of the river. The developments of sewerage systems under a scheme formulated by river basin would be programmed as a whole taking into account of the socio-economic and hydrological conditions of the basin. The program could be worked out with technical section the SUCEAM with a collaboration of the IAP under the control of the SEMA, or Tibagi Sub-basin Agency, while implementation would be discharged by the SANEPAR.

<Program 11 Enhanced Administration of Water Resources Development>

(1) Strengthened Management of Water Resources Development

Currently, major works and facilities are constructed for hydro-power generation throughout the State and for municipal water supply in the Curitiba Metropolitan Area. Management for existing facilities seems to be well conducted with intensive efforts by the sector entities including those for regulatory functions. In the future, however, major construction would be required to meet the increasing demands, and especially multi-purpose facilities would be necessary and recommendable for efficient investment and optimal use of the resources.

(a) Strengthening of Capability of Technical Appraisal and Control

Current regulations of water resources development are considerably weak, despite that the safety of large scale water works is extremely important and their development will potentially cause huge negative impacts on the society. Application, appraisal, permission and control procedure should be established. Forms for the application and guidelines for the appraisal would be necessary to be prepared. Procedures and guidelines for adequate and optimal operation of the facilities and reporting of the operation to the regulatory entities, as well as command lines and warning system in accidental conditions and in hydrological events, such as extraordinary flood or severe drought, should also be elaborated. Hydro-

power sector, where technical appraisal is assumed by the ELTROBRÁS, could be a model for the preparation.

(b) Environmental Impact Assessment and Measures to be taken for Resettlement

A great deal of impacts could occur by water facility development, especially by those with reservoir development, while environmental requirements are escalating. "Plano Diretor de Meio Ambiente do Setor Elétrico, 1991/1993" could also be a good model for other sectoral water resources development and multi-purpose facility projects.

Resettlement might often damage, sometimes seriously, the living conditions of resettlers, and in some cases, of those of inhabitants who accept the resettlers near their living areas. Preparation for defining the procedure of implementation of lands acquisition and subsequent resettlement would be necessary prior to the planning of major water resource development. Planning a resettlement scheme should be combined into the project planning. The cost of resettlement should also be included in the cost of the project.

(c) Examination of Compensation Discharge

A reservoir development affects on run off in down stream, which might damage some functions of the river, such as navigability, or fishery and eco-system preservation. Full use of reservoir storage and assuring compensation discharge for normal functioning of the stream would be a controversial trade off with the demand increase in quantity and quality. Compensation discharge should be tightly determined by basin by basin, taking into account of the needs and the priority among them.

(2) Cost Allocation for Construction, Operation and Maintenance

Construction of multi-purpose water facilities including flood control functions is found efficient investment corresponding to socio-economic development when and where natural flow cannot meet the demands, and the cost for sectoral development and for protection of valuable properties and assets located in flood prone areas will increase. Multi-purpose facilities should be promoted to meet the requirement for increasing investment with limited financial resources. A method of cost allocation might be necessary to be elaborated. The Japanese cost allocation method, as described in the Sectoral Report Vol. M, Institution, can be introduced as a model.

These calculations should be conducted by the entity in charge of the water resources management (SUCBAM under the control of SEMA or a Basin Agency under the guidance of Basin Committee), with the unified cost estimation standards. The cost allocated to each sector, such as hydro-power, water supply or irrigation, could be charged on consumers of the service through respective tariff collection system. The cost allocated for flood control purpose could be covered by the tax collection imposed on the assets of the area.

<Program 12 Water Pricing and Charging for Optimal Water Allocation and Demand Control >

Water would be transformed into an economic good when the water resources as considered as limited resources corresponding to the demand escalation. Principle of opportunity cost pricing would be recommendable to be introduced, especially in the Upper Iguaçu River Basin. Opportunity cost includes the following three components: i) resource use cost: the

economic value of goods or service forgone by the commitment of construction and operation for the use, ii)natural resource depletion cost in terms of quantity and quality, and iii) damage cost incurred by the use.

As for the resource use cost, the discussions are given above and Chapter 10 of the Main Report I. The natural resource cost might vary according to; i) volume of intake, ii) location of intake, ii) season of intake, iii) ratio of return flow iv) quality of natural water and required for the use. Damage cost should be discussed as compensation or fine. Cost for natural resource depletion in practice might lead to charging; i) by quantity, ii) by basin, iii) by purpose of use, and for iv) effluent discharge by volume and by quality. Even though actual modifications of the pricing can be made as social or industrial promotion subsidy or income re-distribution, opportunity cost should be analyzed by basin and for each type of use, and modifications should be made explicitly with statement of the reason and amount of modification in pricing drafting. Charging for effluent discharging can be separately be discussed from damage compensation or fines against disobedience of the standards.

Establishment of a unit or staff enhancement for the investigation and policy drafting for water pricing would be necessary in the SUCEAM or a Basin Committee, coupled with strengthened coordination with economic planning and statistics section of the Government. This unit or enhanced staff could also be responsible for regulatory functions on water supply and sanitation tariff from point of economic view as well.

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CHAPTER 10 COST ESTIMATE, AND ECONOMIC AND FINANCIAL EVALUATION

10.1 Cost Estimate

The project costs required for the implementation of major sectors in Master Plan were roughly estimated and summarized as shown in Table-10.1. The cost estimate was carried out considering the following items.

1) The cost consists of preparatory work, main construction cost, direct cost of equipment, land acquisition, administration, engineering service and contingency.

2) The cost was estimated based on the price level and exchange rate, 1 US$ = 0.89 R$, as of August 1994.

3) Unit prices for construction works are based on "Table of Composite Unit Price July 1994, SANEPAR".

4) Administration and engineering service cost is assumed to be 15 % of the total of direct construction cost and preparatory work cost, while preparatory work cost is assumed to be 10 % of direct construction cost.

5) The cost for water supply sector was estimated by modifying the cost estimate in the document "The Master Plan of Water Supply in the Metropolitan Region of Curitiba, June, 1991 - SANEPAR".

6) The cost for sewage treatment sector was estimated by modifying the cost estimate in the document "The Master Plan of Sewage Treatment in the Metropolitan Region of Curitiba, September, 1993 - SANEPAR".

7) The cost for terracing was estimated based on the data of EMATER.

8) The cost for non-tillage was estimated by assuming machinery cost, it's durability, capacity, etc.

9) The cost for hydroelectric power generation was estimated by converting the cost estimated by COPEL to 1994 price level.

Table-10.1 Rough Project Cost for Tibagi River Basin

Sector		Scale of Sector	Project Cost (10^6US$)
Domestic and Industrial Water Supply		267,000 m^3/day	159.8
Agricultural Water Supply		8,000 m^3/day	1.0
Sewage Treatment		100,000 m^3/day	88.6
Flood Control			--
Soil Erosion Protection	Terracing with Farm Road	3,344 km^2	34.1
	Non Tillage	2,530 km^2	18.7
	Sub-total	5,874 km^2	52.8
Afforestation		2,400 km^2	157.0
Total			459.2
Hydroelectric Power Generation		1,096 MW	1,147.3
Grand Total			1,606.5

10.2 Economic Analysis

10.2.1 Objectives and Target Areas

This section presents an outline of an economic analysis carried out for the proposed Master Plan for the Tibagi River Basin. The objective of the analysis is to assess the magnitude of economic return to the proposed Master Plan by sector from the perspective of overall economy.

The result of the economic analysis would serve as the basis for making a judgment in promoting each component to the feasibility study stage and making a comparison among each of the Master Plan components. A cost-benefit analysis derived economic internal rates of return (EIRRs), benefit - cost ratios and net present values for each component.

The target areas of the economic analysis are the following. The selected areas are those for which economic benefits could be quantified.

- water supply
- sewerage
- soil erosion
- hydropower

10.2.2 Results of the Analyses

(1) Common Assumptions

The following are the assumptions underlying all the sectors.

a) An evaluation period of each sector are determined based on such factors as the life of the facilities and present practice of the related organizations.

b) A construction period of each sector is determined based on the average length needed for constructing the facilities of each sector.

c) A conversion factor of 0.85 is applied to adjust the investment and operation and maintenance costs in order to correct for price distortion. The total cost was adjusted using the conversion factor based on the judgment that the proportion of foreign currency in the investment cost of the past projects in Paraná was marginal.

d) The exchange rate applied is R$0.89 = US$1.0.

(2) Water Supply

Assumptions

A cost-benefit analysis for water supply sector was conducted based on the following assumptions.

a) An economic analysis was conducted for the urban water supply component. The rural water supply component was not included in the analysis since the magnitude of the investment is marginal.

b) A construction period of 4 years and an evaluation period of 30 years are assumed.

c) The volume of water to be supplied by the proposed system is divided into domestic and industrial use based on the proportions derived in the water demand projection for each town.

d) Economic benefit was estimated to be 0.93 US$/$m^3$ for domestic water composed of 0.62 US$/$m^3$ as the present average tariff level collected by SANEPAR and 0.31 US$/$m^3$ as the assumed consumer surplus. Industrial water supply benefit is estimated to be 0.56 US$/$m^3$, the average of SANEPAR's tariff on industrial water and unit water cost of direct abstraction.

e) Water losses are assumed to be 25% for domestic water and 10 % for industrial water. Benefit, therefore, is estimated for the volume measured at the point of consumers.

Results

The following EIRRs were derived.

- Ponta Grossa(A) : 37.58 %
- Londrina-Cambe (A) : 34.12 %
- Apucarana (A) : 40.88 %
- Castro (B) : 46.69 %
- Telemaco Borba (B) : 35.57 %
- Irati (B) : 7.09 %
- Corneiro Procopio (B) : 10.79 %
- Arapongas (B) : 17.55 %
- Ibipora (B) : 19.08 %
- Total of Type A cities : 35.98 %
- Total of Type B cities : 22.82 %
- Total of Type C cities : 12.90 %

Note : (A) ; type A cities (those with a population of more than 100,000 in 2015) , (B) ; type B cities (population between 50,000 and 100,000 in 2015), (C); other than (A) and (B)

Various information in Paraná and Brazil indicates that the opportunity cost of capital (OCC), which is a criterion against which an EIRR can be compared, is somewhere between 10 % and 12 %. The derived EIRRs of the type A and B cities range between the highest in Apucarana at 40.9 % and lowest in Irati at 7.1 %. Overall the EIRRs for all the type A and B cities in the Tibagi River Basin are calculated at 36.0 % and 22.8 % respectively implying sufficient economic return to investment. The EIRR of the type C cities is 12.9%, reflecting lower investment efficiency for smaller cities with more rural characteristics.

Conclusion

It is concluded that the urban water supply component of the Tibagi River Basin, in general, shows sufficient economic return to investment. It is judged that these water supply projects

in the Tibagi River Basin are worth promoting to the feasibility study stage for a detailed analysis. In order to make a more rigid judgment on investment justification, the following aspects should be refined and incorporated into an economic analysis in the feasibility analysis stage.

a) a detailed estimate of investment cost and operation and maintenance cost

b) an estimate of benefit reflecting economically optimum tariff level and consumer surplus

(2) Sewerage

Assumptions

A cost-benefit analysis for the sewerage component was carried out based on the following assumptions.

a) A construction period of 4 years and an evaluation period of 30 years are assumed.

b) Present average tariff level at 0.58 US$/m^3 is used as the economic benefit as a proxy of the wiliness-to-pay of customers.

Results and Conclusion

The following EIRRs were derived.

- Ponta Grossa : 18.56 %
- Londrina : 20.56 %

Both Ponta Grossa and Londrina show high economic return to investment largely surpassing the OCC at 10 %. Real EIRRs would be higher than the above figures since the benefit applied captures only part of actual willingness-to-pay of customers and do not reflect improved water quality affecting non-customers.

In the feasibility analysis stage, a more detailed analysis should be made covering the following items.

a) a detailed estimate of investment cost and operation and maintenance cost

b) an estimate of benefit reflecting :

- economically optimum tariff level and consumer surplus
- quantification of external effect (economic impact of water quality improvement for non-customers)

(3) Soil Erosion Prevention

The Master Plan proposes soil erosion prevention measures for an area of 534 thousand ha in total in the Tibagi River Basin. There are altogether 9 locations planned under the Master Plan. An economic analysis was conducted for the total of all the nine components.

Assumptions

a) An evaluation period of 30 years is assumed.

b) A construction period of 1 year is assumed.

c) The cost of fertilizers to be saved by the project is employed as the economic benefit.

Result and Conclusion

An EIRR is derived at 8.36%. This EIRR shows the minimum level of EIRR expected. Actual EIRR would be much higher than this level since a number of expected benefits were not included in the present analysis due to the limited availability of data needed for quantification. They would include a rise in agriculture productivity, reduction in the water treatment cost due to a fall in sedimentation volume and reduction in fertilizer use leading to improved water quality. A higher EIRR would be expected once a more detailed economic analysis in the feasibility study stage succeeds in quantifying these benefits.

(4) Hydropower

Project to be Analyzed

The hydropower projects planned to start operation by the year 2015 in the Tibagi River Basin are the following (Figures indicate the year of starting operation.) : São Jeronimo (2006), Jataizinho (2002), Cebolao (2003), Maua (2007) and Telemaco Borba (2008).

Assumptions

The following assumptions are set.

a) An evaluation period of 50 years is set.

b) A construction period of 5 years is assumed.

c) The operation and maintenance cost is assumed to be 0.5% annually of the investment cost.

d) Economic benefit from consumption is set at 72 US$/MWh. Benefit from demand both in the peak and out-of-peak time is assumed to be 17% of the consumption benefit.

Result and Conclusion

The following EIRRs were derived.

- Sao Jeronimo : 27.8 %
- Jataizinho : 25.3 %
- Cebolao : 25.6 %
- Maua : 25.0 %
- Telemaco Borba : 25.2 %

All the hydropower projects planned in the Tibagi River Basin prove to be economically viable at the Master Plan stage. Promotion to the feasibility study stage is justified.

10.3 Financial Analysis

10.3.1 Objective

A financial analysis was conducted for the water supply component and sewerage component. The objective of the financial analysis is to evaluate the return to investment from the perspective of implementing agency.

10.3.2 Water Supply

Methodology and Assumptions

Financial internal rates of return (FIRR) were derived for each component of the water supply sector. The following are the assumptions.

a) The investment cost presented in section 10.1 are applied. Operation and maintenance costs are assumed to be 9% of the investment cost.

b) Revenue is estimated based on the present average revenue per cubic meter collected by SANEPAR : US$ 0.62/m^3 for domestic use and US$ 1.10/m^3 for industrial use.

c) The volume of water to be supplied by the proposed system is divided into domestic and industrial uses based on the proportions derived in the water demand projection for each town.

d) Water losses are assumed to be 25% for domestic water and 10 % for industrial water. Revenue, therefore, is estimated based on the amount measured at the point of consumers.

Result and Conclusion

The following FIRRs are derived.

Unit: %

Area	Industry + Domestic	Domestic only
Type A		
Ponta Grossa	34.55	27.43
Londrina-Cambe	25.53	22.30
Apucarana	35.91	29.56
Type B		
Castro	51.06	38.54
Telemaco Borba	36.10	27.13
Irati	4.66	--
Comeiro Procopic	7.34	3.29
Arapongas	16.45	11.29
Ibipora	12.97	10.11
Total of Type A cities	29.50	24.79
Total of Type B cities	22.01	15.50
Total of Type C cities	9.41	5.41

Note: "—" means negative

FIRRs are derived for two cases : the first case of industrial use and domestic use combined and the second case of domestic use only. The first case assumes that all the industries would pay the industrial water tariff at US$ 1.10/m^3. The second case focuses only on

domestic water supply.

Since data on real interest rates in Paraná was not available, it is difficult to make a straight judgment on these FIRRs. In general, however, it can be judged that most of the components will generate sufficient return to operate the system in a sound manner. The derived FIRRs would also serve as a criterion for the following objectives.

- loan procurement for implementing organizations such as SANEPAR
- adjustment of tariff level reflecting different level of cost efficiency among different regions
- decision on investment in water supply project by the private sector

10.3.3 Sewerage

Methodology and Assumptions

Financial internal rates of return (FIRR) were derived for the sewerage components in Ponta Grossa and Londrina. The following are the assumptions.

a) The investment cost presented in section 10.1 is used. Operation and maintenance costs are estimated based on the data supplied by SANEPAR.

b) Revenue is estimated based on the present average revenue per cubic meter collected by SANEPAR : US$ 0.58/m^3.

Results and Conclusion

The following FIRRs are derived.

- Ponta Grossa : 15.95 %
- Londrina : 17.73 %

It is judged that these levels will be sufficient for a sound financial management of the sewerage system. These FIRRs can be referred to in making various judgments in the same manner as mentioned for the water supply component.

CHAPTER 11 RECOMMENDATIONS

11.1 Studies for Urgent Implementation

Such studies as described below are recommended to be conducted urgently, following this Study.

(1) Feasibility Study on Water Supply and Sanitation in Londrina

Londrina has the second largest water demands, next to Curitiba. A feasibility study on water supply is necessary to be conducted, coupled with a study on sewerage development, taking into account of prospective water contamination in downstream rivers due to the location of the city on mountain top.

(2) Feasibility Study on Water Supply and Sanitation in Ponta Grossa

Ponta Grossa has sufficient potential to develop as a satellite area of Curitiba. The population and industries will grow in the near future, causing problems in water supply and sanitation. Therefore, a feasibility study on the matters will be required.

11.2 Master Plan Study for Other River Basins than the Pilot River Basins of the Study

The Study formulates the Strategy to cover the whole state, and the Master Plan for Iguaçu and Tibagi River Basins, after the selection of the two basins as the Pilot River Basins. For other seven (7) river basins, Master Plan studies should be conducted as soon as possible. The Steering and the Technical Committees established for the Study are expected to facilitate those Master Plan studies.

11.3 Review of Other Development Plans

The Strategy and the Master Plan proposed in the Study are formulated from the viewpoint of water environment applying various assumptions and estimates on socio-economic conditions. In other development plans, such as those for socio-economic development, regional development, industrial development of various sectors, and transportation and road network development, programs and projects should be planned taking into account of the proposals made in the Study from the viewpoint of water environment. For example, in order to restrain the population concentration occurred in the Curitiba Metropolitan Region and to distribute the population and industries to regional poles, concrete schemes should be examined and programmed in regional development plans.

11.4 Implementation and Review of the Proposed Projects

In order to promote socio-economic development and to raise the living standards and to enjoy conserved or improved water environment, projects and programs proposed in the Study should be implemented steadily. Since the projects and programs are planned based on the estimated socio-economic framework in target years of 2005 and 2015, the plans should be reviewed every five years or when necessary, according to the changes in socio-economic conditions.

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