

Chapter III REGIONAL WATER SUPPLY ADMINISTRATION SYSTEM

3.1 Introduction

Water supply management is being carried out by the Empresa de Servicios Sanitarios de Tarapacá (Tarapacá Sanitary Services Enterprise, ESSAT). It is a stock company established on April 9, 1990 and replaced the Servicio Nacional de Obras Sanitarias, SENDOS Región I (National Service for Sanitary Works, SENDOS Region I.)

ESSAT has only two shareholders, Corporación de Fomento para la Producción (Production Promotion Corporation, CORFO) and the Public Treasury. The former owns 99% of the shares and the latter, 1%.

The objective of ESSAT is to produce and distribute drinking water, recollect, treat and dispose sewage water, and carry out other services related to such activities in the way and manner established in the Decree-Laws Nr. 382 and Nr. 70, both issued in 1988 by the Ministry of Public Works.

ESSAT serves the Tarapaca Region (Region I) that includes Arica, Iquique, Pozo Almonte, Pica, Matilla, La Tirana, La Huayaca, Huara, and Pisagua.

3.2 Administration and Human Resources

3.2.1 ESSAT Administrative Organization

ESSAT is managed by a Board of Directors composed by seven members who are appointed for a two-years period. The directors are designated by the Ordinary Meeting of Shareholders.

In turn, the Board of Directors elects its own President and Vice-President and designates the General Manager.

There are the following Managerial Departments:

- General Management
- Engineering
- Administration and Finance
- Planning

Arica and Iquique have Provincial Branches and their managers also belong to the top management of ESSAT.

Besides the above mentioned Managerial Departments, ESSAT has the following Counseling Units:

- Legal
- Internal Control
- Rural Drinking Water
- Public Relations

The Engineering, Administration and Finance, and Planning Management Departments, and the Iquique and Arica Provincial Branches all depend on the General Management Department.

The Engineering Management Department carries out studies concerning drinking water and sewerage, and set the technical norms for operation of the firm; it also coordinates and controls the operation and maintenance programs, water quality, and evacuation of sewerage.

The Administration and Finance Management Department is in charge of administration of human, financial, and information resources related to administrative and commercial aspects of the firm. This Department sets norms and policies seeking to maximize revenues, minimize costs and optimize utilization of human and material resources and required services for operation of the firm. It also sets the norms regulating the relationship on commercial matters between the firm and its clients.

The Arica and Iquique Provincial Branches are responsible for the operation and maintenance of the installations, works, and equipment of the drinking water and sewerage systems. They also are in charge of water and sewerage services fee invoicing and collection.

Personnel is made up of 289 people at the end of 1993 and is classified as shown below:

Top management	10
Technical staff	53
Other staff	226
TOTAL	289

Source: ESSAT 1993 Annual Memory

Second-level chiefs, professionals and qualified personnel are considered as technical staff. Administrative staff, drivers, watchmen, etc. are within the "Other Staff" category.

Remuneration are decided based on collective agreements reached between the management and workers. These agreements contemplate the semi-annual readjustment of remuneration up to a 100% of the variation of the consumer's price index.

3.3 Description of Activities

3.3.1 Clients and Service Coverage

By the end of 1993, ESSAT was supplying water services to 77,264 clients and sewerage services to 73,845 clients. It meant that almost 98% of the population of the Region in 1993 received drinking water services while 96% was covered by sewerage services.

See Table F, 3.1 and F, 3.2 for details.

Clients can be classified as shown in Table F, 3.3

In order to offer better services to its clients, ESSAT has 24 offices where they can make payments and 5 centers for general consultations.

3.3.2 Main Installations

Main installations of ESSAT correspond to the infrastructure for production and distribution of networks for normal supply of water and recollection system and final disposal of sewerage. Details are shown in Table F, 3.4

3.4 Water Production and Billing

3.4.1 Production and Billing

Water production and billing for the period 1990-1993 are shown below:

Year	Production	Billing	(Unit: Million M ³)
			Production/Billing (%)
1990	35.891	21.327	59
1991	34.787	22.031	63
1992	35.692	22.494	63
1993	38.189	21.466	56

Source: ESSAT 1993 Annual Memory

Invoicing is done on a monthly basis for all clients and during the period, 97% of total invoiced tariff was actually collected. Tariff collection efficiency is shown below.

Year	Invoiced (\$)	Collected (\$)	(Unit: Million Pesos)
			Collection Efficiency (%)
1990	2,371	2,237	94
1991	3,549	3,549	95
1992	4,430	4,244	96
1993	5,529	5,349	97

Source: ESSAT 1993, 1992 Annual Memories

Desegregated data on water production, billing, and collected water fees for Iquique Provincial Headquarters, and Arica Province can be seen in the Tables F, 3.5 and 3.6 respectively.

3.4.2 Tariff System

Tariffs are set by the Government through the Ministry of Economy, Foment and Reconstruction. The tariffs are denominated "self-financing tariffs" because they are set aiming to cover the costs of the water supply companies; they are based on an economic-efficiency point of view and take into consideration the long-term development and growth costs of the companies. The Government sets the "self-financing tariffs" or "target tariffs" which must be reached in a period of 5 years; it means that ESSAT has 5 years to reach those tariffs. Tariffs are adjusted based on two concepts:

- Through adjustment of the tariffs themselves: They correspond to an annual percentage increase determined by the Government in order to reach the "self-financing tariffs" within the established period of 5 years (1990 to 1994.)
- Through readjustment of the price indexes considered in the formulas applied for setting up the tariffs: Readjustments will be applied each time any of the indexes shown below raise above 3%.

The indexes are:

PIC	=	Price Index of Cement
PII	=	Price Index of Iron
PIR	=	Price Index of Remunerations
PIIE	=	Price Index of Industrial Electricity
PIPD	=	Price Index of Petrol Diesel
WPI	=	Wholesale Price Index
WPIIP	=	Wholesale Price Index of Imported Products

Tariffs applied at present by ESSAT corresponds to 75% of the "self-financing tariffs" set up by the Government.

The present "self-financing tariffs" were established through Legislative Decree No.376 issued on November 15, 1990 by the Ministry of Economy, Foment, and Reconstruction.

The tariff structure contemplates charging to the clients the following charges:

- Fixed Charges for Water and Sewerage: These charges are independent from water and sewerage services consumption.
- Fixed "Client Charges": These charges aim to cover the expenses incurred by ESSAT when attending the clients like water meter reading, inspections, etc.
- Variable Charges: These charges depend on the water consumption measured in cubic meters.
- Over-consumption Variable Charges: They are applied during the summer season, denominated "peak season", from December to March to the consumption over the average consumption obtained during the "off-peak season" from April to December. These charges apply to consumption over 30 m3.

The tariffs applied at present by ESSAT for Arica and Iquique are as shown in Table F, 3.7 and 3.8 respectively.

3.5 Budget and Investment

3.5.1 Budget

The budget for the year 1993 was 3,296 Million Pesos and was 17% higher than the one for 1992. See below for details.

(Unit: Million Pesos)								
Items	1993	%	1992	%	1991	%	1990	%
Remuneration	839	25	733	26	571	24	364	19
Services	303	9	225	35	167	20	139	7
Materials	167	5	176	6	125	5	46	2
Energy	1,579	48	1,395	50	1,328	55	1,258	66
Fuel	52	2	42	1	35	2	22	2
Overhead costs	356	11	249	9	171	7	84	4
TOTAL	3,296	100	2,820	100	2,397	100	1,913	100

Source: ESSAT 1993, 1992 Annual Memories

Total revenue collected during 1993 was \$7,627 Million. Breakdown of the revenues is shown below:

(Unit: Million Pesos)								
Items	1993	%	1992	%	1991	%	1990	%
Water Sale	5,349	70	4,244	79	3,372	83	2,237	98
Investment Profits	126	2	47	1	17	--	17	1
Transfers	1,913	25	1,077	20	680	17	--	--
Other Revenues	240	3	2	---	1	--	18	1
TOTAL	7,627	100	5,370	100	4,070	100	2,272	100

Source: ESSAT 1993, 1992 Annual Memories

3.5.2 Investment

During 1993 a total of 6,635 Million Pesos were used for projects related to water and sewerage services. In 1993 4,952 Million Pesos were used for investment.

The investment breakdown is shown in Table F, 3.9.

3.5.3 Main Projects

The following three projects were the main investments made during 1993 by ESSAT.

1) Integral improvement of sewerage system of Iquique

The total cost of this project is 3,000 Million Pesos (1,822.4 Million Pesos were used in 1993) and included the construction of two interceptor sewers with a length of 4,272 meters, a modern pumping station with a capacity of 600 liters per second, and two submerged outlets (one of them of 1,550 meters and diameter of 900 mm and the other of 1,340 meters and a diameter of 800 ,mm) with a 40 meters long "Y" form dispenser.

2) Improvement of water supply system of Arica

The improvement of the water supply system of Arica reached a cost of 1,133 Million Pesos and covered the construction of an transmission pipe of 10,000 meters with a diameter of 350 mm, the construction of two drillings and the re-boring and rehabilitation of 14 drillings. This project will allow ESSAT to increase its production and distribution of water to the city with a flow capacity of 300 liters per second.

3) Sanitary infrastructure for Alto Hospicio

The designed water supply system reached a cost of 351 Million Pesos and consists of a feeder matrix of 3,124 meters, a distribution network of 9,789 meters from which at a first stage 1,027 connections will be served representing around 5,135 persons.

The sewerage system reached a cost of 612 Million Pesos and covers a sewerage network of 14,079 meters and two stabilization ponds of 24,490 m².

3.5.4 Financing

ESSAT has the following financing sources:

(Unit: Million Pesos)

Finance Source	Studies	Works	Total Investment
Own resources	92.3	879.5	971.8
Ministry of Public Works		877.0	877.0
Inter-American Development Bank		1,027.0	1,027.0
Regional Sectorial Investment Allocation		64.8	64.8
Regional Development National Fund	4.1	762.3	766.4
Ministry of Housing and Urbanism		345.3	345.3
Total	96.4	3,955.9	4,052.3

Source: ESSAT 1993 Memory

Table F, 3.1 Clients and Water Service Coverage
<Clientes y Alcance del Servicio de Agua>

Service Community	1993		1992		1991	
	Clients (Number)	Coverage (%)	Clients (Number)	Coverage (%)	Clients (Number)	Coverage (%)
Arica	38,821	99	37,423	99	34,770	99
Iquique	35,126	98	33,332	98	30,175	98
P.Almonte	1,061	95	920	95	786	94
Pica	967	100	943	100	865	100
Matilla	270	100	261	100	248	100
La Tirana	1,042	85	1,000	85	928	78
La Huayca	132	100	122	100	110	100
Huara	172	100	159	100	148	100
Pisagua	73	100	57	100	53	100
TOTAL	77,664	100	73,845	100	74,217	100

Source: ESSAT 1993, 1992 Annual Memories

Table F, 3.2 Clients and Sewerage Service Coverage
<Clientes y Alcance del Servicio de Desagüe>

Service	1993		1992		1991	
	Clients (Number)	Coverage (%)	Clients (Number)	Coverage (%)	Clients (Number)	Coverage (%)
Arica	38,238	98	36,924	98	34,222	97
Iquique	34,502	96	32,815	96	28,961	94
P.Almonte	709	95	587	61	484	58
Pica	396	41	388	41	244	28
TOTAL	73,845	96	70,714	96	63,911	95

Source: ESSAT 1993, 1992 Annual Memory

Table F, 3.3 Classification by Type of Client
<Clasificación por Tipo de Cliente>

Year	1993				1992			
Type Client	Water	%	Sewerage	%	Water	%	Sewerage	%
Residential	71,462	92	68,516	93	68,123	92	65,429	93
Commercial	3,262	4	2,725	4	3,442	5	2,879	4
Industrial	2,098	3	1,916	2	1,849	2	1,730	2
Others	842	1	688	1	803	1	676	1
TOTAL	77,664	100	73,845	100	74,217	100	70,714	100

Source: ESSAT 1993, 1992 Annual Memories

Table F, 3.4 Main Installations of ESSAT
<Instalaciones Principales de ESSAT>

Water Connections	Arica Province: 38,821 Arica City: 38,821 Iquique Province: 38,843 Iquique City: 35,126
Sewerage Connections	Arica Province: 38,238 Arica City: 38,238 Iquique Province: 35,607 Iquique City: 34,499
Water catchment	Arica: 29 drillings
Water catchment	Iquique: 26 drillings
Water conduction	Arica: 19,175 m.
Water conduction	Iquique: 177,348 m.
Water pumping stations in Arica:	4 with a capacity of 277 l/s
Water pumping stations in Iquique:	5 with a capacity of 1,706 l/s
Water reservoirs in Arica:	8 with a storing capacity of 14,500 m ³
Water reservoirs in Iquique:	38 with a storing capacity of 78,700 m ³
Water distribution networks in Arica:	372,637 m.
Water distribution networks in Iquique:	246,942 m.
Sewerage distribution networks in Arica:	350,629 m.
Sewerage distribution networks in Iquique:	227,678 m.
Sewerage pumping stations in Arica:	2 with a capacity of 600 l/s
Sewerage pumping stations in Iquique:	3 with a capacity of 1,300 l/s

Source: ESSAT 1993 Annual Memory

Table F, 3.5 Detailed Data on Water Production and Billing (Iquique Headquarters)

<Datos Detallados del Volumen de Agua y Su Costo (Oficina Principal de Iquique)>

Iquique Provincial Headquarters	Water Production	Water Services Billing (M ³)	Total Collected Water Fees (\$)	Water Services Billing (\$)
December'90	1,578,855	943,047	133,433,556	150,867,640
January'91	1,471,900	901,693	158,444,198	154,128,918
February'91	1,292,200	994,407	178,035,784	186,821,817
March'91	1,471,800	980,218	160,713,457	170,927,724
April'91	1,286,500	891,440	143,414,760	188,997,517
May'91	1,321,500	833,525	133,003,065	160,945,303
June'91	1,285,900	816,529	151,179,436	158,512,877
July'91	1,322,900	1,137,768	132,476,537	116,594,394
August'91	1,471,200	1,027,699	135,477,075	128,999,655
September'91	1,425,800	901,101	147,901,792	154,794,235
October'91	1,584,400	739,275	155,024,340	141,287,066
November'91	1,385,300	953,743	150,201,308	197,485,115
December'91	1,751,700	691,962	179,408,411	246,292,111
January'92	1,848,600	879,089	176,570,906	187,221,293
February'92	1,730,000	756,945	190,794,392	176,832,040
March'92	1,614,000	941,452	196,509,178	221,347,864
April'92	1,542,200	923,285	195,214,314	205,049,369
May'92	1,519,300	1,157,011	189,690,872	192,218,995
June'92	1,454,100	886,757	186,273,242	185,950,293
July'92	1,424,300	900,135	176,605,715	190,311,800
August'92	1,430,300	907,951	208,624,836	235,988,694
September'92	1,430,800	836,123	199,796,313	209,525,605
October'92	1,509,400	916,546	224,520,881	242,293,258
November'92	1,515,500	935,215	200,229,432	249,628,525
December'92	1,617,400	955,648	229,841,170	270,666,095
January'93	1,929,400	1,008,297	216,727,873	292,596,517
February'93	1,743,500	1,102,505	288,265,898	353,575,193
March'93	1,889,300	1,032,056	325,469,150	303,529,551
April'93	1,810,900	1,002,925	325,613,293	272,354,680
May'93	1,843,600	1,011,148	267,374,730	259,243,181
June'93	1,842,900	900,502	261,120,686	234,882,742
July'93	1,889,400	1,013,879	272,596,444	276,524,585
August'93	1,709,900	888,231	247,528,910	246,533,929
September'93	1,642,300	991,776	261,950,668	283,775,257
October'93	1,771,900	910,549	244,783,716	255,106,234
November'93	1,707,400	973,268	244,605,192	288,630,231
December'93	1,717,500	0	270,710,291	0
Total	58,783,855	33,643,700	7,560,142,221	7,770,440,303

Source: ESSAT

Table F, 3.6 Detailed Data on Water Production and Billing (Arica City)

<Datos Detallados del Volumen de Agua y Su Cost (Ciudad Arica)>

Arica City	Water Production	Water Services Billing (M ³)	Total Collected Water Fees (\$)	Water Services Billing (\$)
December'90	1,412,177	938,134	114,988,926	147,159,513
January'91	1,577,300	694,080	122,242,572	125,558,055
February'91	1,565,500	897,178	137,903,017	135,894,904
March'91	1,501,900	925,488	138,018,957	131,008,356
April'91	1,441,200	853,244	128,229,744	97,025,873
May'91	1,482,800	838,614	130,741,333	107,692,810
June'91	1,464,900	947,188	118,031,571	165,363,112
July'91	1,461,800	942,528	114,170,994	136,419,181
August'91	1,485,500	1,014,147	122,644,509	145,790,633
September'91	1,483,800	959,372	121,604,469	147,139,355
October'91	1,428,200	1,064,815	138,502,364	204,966,034
November'91	1,420,000	825,986	140,599,616	151,781,890
December'91	1,422,500	831,871	136,880,236	153,401,975
January'92	1,515,500	938,814	163,316,777	173,354,546
February'92	1,342,700	823,814	158,086,385	171,471,508
March'92	1,457,800	790,128	165,866,309	164,052,000
April'92	1,433,800	1,005,203	163,195,747	162,573,796
May'92	1,424,100	986,476	150,695,550	145,305,705
June'92	1,363,700	788,871	140,768,593	151,301,933
July'92	1,452,000	1,155,936	163,306,975	150,692,442
August'92	1,394,800	746,754	145,390,839	159,351,018
September'92	1,362,600	738,650	156,020,260	152,807,431
October'92	1,443,500	748,621	156,060,587	162,286,543
November'92	1,351,800	784,559	162,327,965	168,551,971
December'92	1,398,400	782,766	148,295,198	180,079,884
January'93	1,420,900	789,178	176,530,527	191,233,825
February'93	1,233,200	844,767	177,293,999	204,845,888
March'93	1,402,400	793,267	194,623,008	185,787,379
April'93	1,302,000	812,517	193,331,940	175,978,142
May'93	1,280,100	829,086	173,295,807	178,211,702
June'93	1,317,800	702,470	167,104,708	157,198,926
July'93	1,566,600	874,336	183,740,178	187,453,078
August'93	1,614,900	817,042	159,201,851	166,972,794
September'93	1,496,600	863,596	186,805,349	193,416,366
October'93	1,525,300	771,098	178,625,542	181,625,745
November'93	1,438,800	822,551	156,299,025	191,327,101
December'93	1,635,700	0	187,582,068	0
Total	53,322,577	30,916,146	5,672,323,495	5,802,081,414

Source: ESSAT

Table F, 3.7 Water and Sewerage Tariffs for Arica (February 1994)

<Datos Detallados del Volumen de Agua y Su Cost (Ciudad Arica)>

1. GROUP No.1: ARICA-Pica-Matila-La Huayca

1.1.- Monthly Fixed Charge

Service	Water Tariff	Sewerage	Client
Diameter (mm)	\$	\$	\$
13 Rebated	231	104	206
15 Normal	334	151	297
19 Normal	667	302	297
25 Normal	1,335	605	297
32 Normal	2,002	907	297
38 Normal	3,003	1,361	297
50 Normal	5,005	2,268	297
75 Normal	11,678	5,293	297
100 Normal	20,019	9,074	297
125 Normal	30,028	3,611	297
150 Normal	45,042	0,416	297
200 Normal	80,075	6,295	297

1.2.- Monthly Variable Charge

	\$ Normal	\$ Rebated
- Water consumption	140.02	108.68
- Water consumption during peak season	140.02	108.68
- Water over consumption	363.74	363.74
- Sewerage without treatment	43.45	25.01
- Sewerage with treatment	51.68	29.75

Table F, 3.8 Water and Sewerage Tariffs for Iquique (February 1994)
 <Datos Detallados del Volumen de Agua y Su Cost (Ciudad Iquique)>

2. GROUP No.2: IQUIQUE-Pozo Almonte-La Tirana-Huara-Pisagua

2.1.- Monthly Fixed Charge

Service		Water Tariff	Sewerage	Client
Diameter (mm)		\$	\$	\$
15	Rebated	209	93	194
15	Normal	337	149	298
19	Normal	675	298	298
25	Normal	1,350	597	298
32	Normal	2,025	895	298
38	Normal	3,037	1,343	298
50	Normal	5,062	2,239	298
75	Normal	11,812	5,223	298
100	Normal	20,249	8,954	298
125	Normal	30,373	13,432	298
150	Normal	45,560	20,147	298
200	Normal	80,995	35,817	298

2.2.- Monthly Variable Charge

	\$ Normal	\$ Rebated
- Water consumption	233.44	130.90
- Water consumption during peak season	230.82	130.20
- Water over consumption	564.20	564.20
- Sewerage without treatment	41.90	19.65

Source: ESSAT

Table F, 3.9 Breakdown of Investment
<Desagregacion de la Inversion>

DETAIL OF INVESTMENT	INVESTMENT (1993)
STUDIES OR DESIGNS:	
Water supply services study	76.7
Sewerage services study	7.7
Other studies	12.0
WORKS:	
Maintenance, repairs and repositions	186.7
Water micro-measure	55.0
Rural water supply works	153.5
Water supply infrastructure for Iquique	314.4
Water supply infrastructure for Arica	1,258.5
Sewerage infrastructure for Iquique	1,822.4
Sewerage infrastructure for Arica	143.6
Real estate investment	21.8
TOTAL	4,052.3

Source: ESSAT 1993 Memory

Chapter IV ECONOMIC EVALUATION

4.1 Introduction

The economic evaluation is made based on the socio-economic evaluation methodology proposed by MIDEPLAN (Ministerio de Planificación : Ministry of Planning of the Republic of Chile) for projects of public interest. The theoretical frameworks is the same explained in the "Guidelines for Preparation of Public Investment Projects" elaborated by MIDEPLAN.

First, benefits and costs are defined and then data are prepared for the application of the SIMOP (Computational Program for Simulation of Public Works) used by MIDEPLAN when evaluating water supply projects.

4.2 Benefits

4.2.1 Concept of Benefit

The benefits are obtained from an increased water supply in a situation of water scarcity.

The benefit coming from an increased water supply can be perceived from the greater willingness to pay of the consumers for the water use price (tariff) charged for the project (in economic terms this is known as "consumer surplus"). In economic terms, the benefit from the extra water supply is represented by the marginal value in use of each water unit contributed by the project. The marginal value-in-use is measured on the demand curves of the consumers.

The value-in-use of any water unit is the maximum amount which the consumer is willing to pay for that unit. The marginal value-in-use is the value-in-use of the last unit of consumed water.

The benefit above mentioned can be measured by using an individual demand curve for a consumer (family group), which indicates the relation between the marginal value-in-use and the water consumption for each time period. However, if there is no restriction for water buying among the consumer groups, the benefits of each of the consumer groups can be measured using an aggregate demand curve.

The water demand of the different consumer groups grows as time goes by, due to the incorporation of new water users and the increase in the consumption per capita. The willingness to pay varies corresponding to the changes in the consumption per capita (this can be caused by increasing income, etc.). In view of these facts, it is necessary to consider various types of demand curves for the consumer groups. These curves simulate

the willingness to pay based on the water consumption patterns and its changes through time.

In this Study, the following three (3) types of demand curve are considered.

4.2.2 Measurement of Benefits

Demand Curve Type I

This demand curve is completely specified if a price and quantity point of the demand curve is known together with the price elasticity at that point. The price elasticity at time 1 is:

$$e_1 = \left[\frac{\Delta Q}{\Delta P} \right]_1 \times \frac{P_1}{Q_1} \quad (1)$$

and rearranging the terms, the formula becomes:

$$\left[\frac{\Delta P}{\Delta Q} \right]_1 = \frac{1}{e_1} \times \frac{P_1}{Q_1} \quad (2)$$

where,

P_1 = Water price (\$/m³) at time 1

Q_1 = Consumption per capita (m³/person) at time 1

$\left[\frac{\Delta P}{\Delta Q} \right]_1$ = Slope of the demand curve at time 1

e_1 = Price elasticity of the demand curve for P_1 and Q_1 values at time 1

Fig. 4.1(1) shows how the demand curve is estimated. Point "A" represents the given values of P_1 and Q_1 , and e_1 is the price elasticity of the demand curve at that point.

From equation (2), the slope of the demand curve is calculated and makes it intercepted with the vertical axis at point "B". In this way, the demand curve is completely defined. Point "P₁" in Fig. 4.1(1) is equal to:

$$B = P_1 + \Delta P \quad (3)$$

By solving equation (2) for ΔP , the following equation is obtained:

$$\Delta P = \frac{\Delta Q}{e_1} \times \frac{P_1}{Q_1} \quad (4)$$

Replacing equation (4) in equation (3) and making $\Delta P = -Q_1$, the following equation is obtained:

$$B = \frac{P_1(e_1 - 1)}{e_1} \quad (5)$$

In this way, the intercept at point B is a function of the water price and the price elasticity of the demand curve at time 1.

In order to shift the demand curve through time, it is assumed that the price elasticity remains constant (at price level P_1) and that the water consumption at time 2. (Q_2) is point "C" in Fig. 4.1(1). Point "C" is then the future water consumption given on the assumption that the price level (P_1) and the price elasticity (e_1) are kept constant. Once this data is known, the demand curve at time 2 is obtained from equation (2). However, it must be noticed that the slope at time 2, $[\Delta P/\Delta Q]_2$ is less negative than at time 1 and that the intercept of the demand curve with the price axis is the same (point "B"). This condition is a direct result of equation (2). If the water price and the price elasticity are kept constant, and if the demanded water amount increase (to point Q_2), then the slope of the curve is less negative (tends to become flatter). The intercept point B is the same at time 1 and time 2 because the price level (P_1) and the price elasticity (e_1) are kept constant as shown in equation (5).

This type of demand curves are used when the shift of the demand curves is caused by the addition of new consumers while the water demand per capita of the old consumers are kept constant.

Demand Curve Type II

In this type of demand curves, the slope of the shifting curves is the same, but the price elasticity is different at each time. Fig. 4.1(2) shows this assumption.

The demand curve at time 2 (D_2) intercepts the water price axis at a higher point (point "D" compared to point "B") because it was assumed that the slope for the demand curve at time 2 (D_2) is the same as the one for demand curve at time 1 (D_1). According to equation (2), if Q increases and P is constant, the price elasticity "e" must decrease in order to keep the slope of the demand curve constant. Equation (5) indicates that the intercept point of a linear demand curve "increases" when "e" decreases and the price level (i.e., P_1) is kept constant.

The shifting of the demand curve type II (from D_1 to D_2) indicates that there are no new water consumers and that the increase of the water demand is caused by an increase in the per capita water consumption of the old water consumers through time. It also shows that

these old water consumers are willing to accept to pay a higher water price for their water consumption. This could be explained by factors like increasing standards of living or income.

Demand Curve Type III

This type of demand curve assumes that the price elasticity is kept constant for all demand curves at any price and quantity level. The form of the demand curve is derived from the following equation:

$$Q = AP^e \quad (6)$$

where,

- Q = Water demand at given time
- A = Factors different from price which affect the water demand (like increase in income, increase in number of household members, etc.)
- P = Water price
- e = Price elasticity of water demand curve

For a given price level (P_1 in Fig. 4.1(3)), the curves shift outwards depending on the factor "A" value mentioned above. The demand curves will keep the same price elasticity irrespective of the different price-quantity combinations which constitute the demand curves. These curves never intercept the price or quantity axis as it is assumed that there is a minimum water quantity which will be always demanded irrespective of the price and there will be always a minimum price to be charged irrespective of the quantity of water demanded.

This type of demand curve characterizes the water consumption of low income consumers. This is so as their water consumption is characterized by the fact that a increase in price would bring about a greater water consumption decrease compared with the Type I and Type II demand curves.

In order to measure the economic benefits of a project which increases the existing water supply capacity, it is necessary to determine what price (tariff) the consumers are willing to pay for the additional consumption of water. In order to obtain the maximum satisfaction from the consumption of the additional units of water, the water must be allocated in such a way that the consumers obtain the same value-in-use from the marginal consumption unit. As mentioned above, the value-in-use of every water unit is the

maximum amount that the consumer is willing to pay for the consumption of that unit. The marginal value-in-use is the value-in-use of the last consumed water unit.

Concerning an individual consumer, it is assumed that the marginal value-in-use decreases according as the amount of consumed water increases through time. Therefore, the measurement of the benefits accrued from a project increasing the available amount of water is to determine what price (tariff) the consumers are willing to pay for the additional water consumption rather than to forfeit its consumption.

The relationship between the marginal water value-in-use enjoyed by a consumer and the water consumption by time can be shown by using an individual demand curve. Even though the marginal value-in-use can not be observed in a direct way, it will be equal to the price (tariff) if the total amount of money spent by the consumer for water consumption is low compared with the total consumption budget of the consumer. If the consumers do not face a restriction concerning water buying, and if it does not matter what consumers receive the additional water, it is possible to measure the economic benefits by using an aggregate water demand.

Fig. 4.2 shows gross economic benefit of the additional consumed water. D_t is the demand curve at time period "t", while D_{t+1} and D_{t+2} represent similar curves in later time. S_t is the existing capacity of the water supply system and p_t represents the average water price (tariff), excluding fixed charges. In time (t+1), changes in population and per capita consumption shift the demand curve outwards, causing an excess demand of $(Q_{t+1} - Q_t)$ at the price (tariff) level of P_t .

The gross economic benefit in time (t+1) of an increased water supply (shown by the supply curve of the new water capacity, S_{t+1}) is given by the area Q_tABCQ_{t+1} . The area Q_tACQ_{t+1} represents the additional income coming from water sales. The triangle ABC represents the consumer surplus associated with the additional water consumption, or in other words, the amount which the consumers are willing to pay for the additional water consumption.

In time (t+2), the aggregate water demand comes to Q_{t+2} , assuming a constant average water price (tariff) of P_t . This amount exceeds the new water capacity of the system by the amount $(Q_{t+2} - S_{t+1})$. In order to eliminate this excess demand in time (t+2), the municipal water administration body (ESSAT) should use a combination of water rationing by raising the water price (tariff) or by imposing quantitative restrictions on water supply. If it is assumed that ESSAT raises the water price to P_{t+2} and that the water supply curve (available water supply) is represented by the line S_{t+1} , then the economic benefit in the time (t+2) is the area S_tDES_{t+1} .

4.3 Concept of Costs

The costs of inputs used in the project must be valued by using the corresponding social prices (shadow prices). The social prices are determined based on the supply and demand balance of physical units demanded by the project, taking into consideration the distortions created by the existence of taxes or subsidies. In other words, the market prices may not reflect the real value of the inputs.

In practice, MIDEPLAN suggests correction for the market prices of the rate of discount, labour, and foreign exchange. In order to obtain the social costs of investment and operation, taxes (VAT: Value-Added Tax), custom duties, and other specific taxes must be excluded.

4.4 Evaluation Methodology

1) Determination of Incremental Investment

The incremental investment is obtained by the difference between the investments made in the "With-Project Situation" and the "Without-Project Situation".

The "without-project situation" are the required investments to keep or improve the actual capacity of the system with small marginal investments. Those investments correspond to the ones included in the on-going development plan of ESSAT including no new water source development.

2) Adjustment of Market Prices

As mentioned above, the market prices do not necessarily coincide with the social prices. In order to obtain the correct social prices to be applied for the evaluation, MIDEPLAN has given the following adjustment factors:

(1) Social Price of Labour

This is the marginal cost incurred by society when employing an additional worker of certain skill.

For skilled labour, MIDEPLAN considers that the market price reflects the true social price of this type of labour. For non-skilled and semi-skilled labor, the adjustment factors are proposed as follows:

Labor:	Non-skilled	0.66
	Semi-skilled	0.73

This means that the market prices of labour shall be decreased by 33% for non-skilled labour and by 27% for semi-skilled labour to obtain the social prices of labour to be used in the project evaluation.

(2) Foreign Exchange

The difference between the social cost of a foreign exchange unit and the market cost of that unit is originated from the existence of distortions in the economy, specially in the internationally tradable goods and services sectors.

MIDEPLAN suggests to use the following adjustment factor for the foreign exchange:

Foreign Exchange: 1.06

This means that the foreign exchange based on the market prices shall be increased by 6% in the project evaluation.

(3) Social Rate of Discount

The social rate of discount corresponds to the cost incurred by the society when the public sector extracts resources from the domestic or foreign private sector to finance its own investments.

The social rate of discount to be used for the evaluation of the Project is suggested by MIDEPLAN as follows:

Social Rate of Discount: 12%

3) Transformation of Incremental Investment

The shares of imported component, non-skilled labour and semi-skilled labour in the incremental investment shall be estimated to transform the incremental investment on market prices into the incremental investment cost on social prices.

The estimated shares for each type of works are as follows.

Type of Works	Imported Component	Labour	
		Non-skilled	Semi-skilled
Intake works	32%	3.8%	2.6%
Transmission	35%	2.6%	13.8%
Treatment	60%	3.6%	2.5%
Distribution	35%	2.6%	13.8%
Electrical works	61%	1.0%	15.0%

The transformed incremental investment (incremental social investment) will give the real opportunity investment cost of the Project.

4) Profitability Indexes

Profitability of the project is measured by using the Net Present Value (NPV) which is the difference between the Benefits Present Value (BPV) and the Costs Present Value (CPV) of the project.

$$BPV = \sum_{i=1}^n \frac{B_i}{(1+r)^i}$$

$$CPV = I_0 + \sum_{i=1}^n \frac{C_{oi} + O_{ci}}{(1+r)^i}$$

where

B_i = Benefit in the period i

I_0 = Investment in period 0

C_{oi} = Operation costs in period i

O_{ci} = Other costs in period i

r = Discount rate

Also, the Benefit/Cost Ratio and the Economic Internal Rate of Return (EIRR) are calculated.

4.5 Computer Evaluation Program (SIMOP)

1) Brief Explanation of Program

MIDEPLAN suggested a computerized evaluation model called SIMOP (Simulación de Obras Públicas : Simulation of Public Works) for the socio-economic evaluation of water supply projects which increase the water availability of the system. It was elaborated by the Interamerican Development Bank. This model identifies and quantifies the above explained social economic benefits. The program differentiates four types of consumer groups based on the definition of their demand curves estimated by using parameters like price (tariff), water demand, and price-consumption elasticity. Water supplies for the "with project" and "without project" situations are defined and water demand is forecasted for the whole evaluation period.

2) Data Requirements

The following data is required for the SIMOP. The data is based on available information for December of 1993.

(1) Evaluation Horizon

The period for the economic evaluation is determined to be 36 years from 1993 to 2028, as it takes such a relatively long period for the Project to render benefits.

(2) Consumer Groups and Demand Characteristics

MIDEPLAN suggests classification of the below mentioned consumers groups with their respective demand characteristics including price elasticity and demand curve type for Arica and Iquique cities.

Group 1: Residential consumption between 1 - 20 m³ (Low-income class)
Price elasticity: -0.52
Demand curve type: 3

Group 2: Residential consumption between 20-30m³ (Mid-income class)
Price elasticity: -0.2
Demand curve type: 2

Group 3: Residential consumption greater than 30m³ (High-income class)

Price elasticity: -0.25

Demand curve type: 2

Group 4: Commercial, industrial, and fiscal consumption

Price elasticity: -0.20

Demand curve type: 1

Further, the demand annual growth rate for each group is required along with the corresponding initial water tariff to complete the demand characteristics.

The demand average annual growth rate for the evaluation period is calculated based on the population projection and forecasted consumption per capita mentioned in Supporting Report C (Water Use).

The initial water tariffs for each group were provided by ESSAT. It must be noted that the tariff for Groups 1 and 2 is lower than the one for Groups 3 and 4 as the former groups have the benefit of a subsidized rate for the first 10m³ of consumed water.

(3) Water Consumption Capacity of the System

This data is based on water consumption capacity in the "with-project situation" and "without project situation". In the "without project situation" the actual water consumption capacity of the system is taken as a data; it may vary through time according to the decrease in water loss. The "with project situation" considers the incremental water consumption capacity coming from the implementation of the project.

(4) Initial Water Consumption

The initial water consumption for each group has been calculated based on the consumption share of each group provided by ESSAT for the year 1993.

(5) Project Costs

The following costs are considered:

Periodic costs: Cover personnel and operation and maintenance incurred annually from the year when the project is in full operation.

Non-periodic costs: Cover the incremental investment costs evaluated at social prices.

Variable costs: Cover electric energy and treatment chemicals costs which vary depending on the volume of water produced.

3) Expected results of the program

The SIMOP program gives the following results:

- (1) Present Value of Benefits for each consumers group
- (2) Present Value of Costs (periodic, non-periodic, and variable)
- (3) Net Present Value
- (4) Benefit Cost Ratio
- (5) Internal Rate of Return

4.6 Results of the Socio-economic Evaluation of the Project

4.6.1 Arica City

1) Input data

- (1) Period of evaluation: 1993-2028
- (2) Water consumption capacity of the system

With-out Project Situation

Year	Thousand M ³
1993	9,500.22
1994	9,539.64
1995	9,579.06
1996	9,776.16
1997	9,933.84
1998	10,091.52
1999	10,249.20
2000	10,722.24
2001	10,879.92
2002-20028	11,037.60

With Project Situation (Additional Water Supply)

Year	Thousand M ³
1999	6,438.39
2000	6,538.99
2001	6,639.59
2002	6,740.19
2003	6,840.79
2004	6,941.39
2005-2028	7,041.99

See Table F, A.1 of SOCIO-ECONOMIC ANNEX for details.

(3) Consumers groups and characteristics:

Group 1: Residential consumption between 1 - 20 m³ (Low-income class)

Price elasticity: -0.52

Demand curve type: 3

Demand growth rate: 0.0389

Initial tariff used for evaluation: \$114.00/m³

Initial water consumption amount: 3,515,000 m³

Group 2: Residential consumption between 20-30 m³ (Mid-income class)

Price elasticity: -0.2

Demand curve type: 2

Demand growth rate: 0.0389

Initial tariff used for evaluation: \$114.00/m³

Initial water consumption amount: 950,000 m³

Group 3: Residential consumption greater than 30m³ (High-income class)

Price elasticity: -0.25

Demand curve type: 2

Demand growth rate: .0740

Initial tariff used for evaluation: \$129.03/m³

Initial water consumption amount: 3,230,000 m³

Group 4: Commercial, industrial, and fiscal consumption

Price elasticity: -0.20

Demand curve type: 1

Demand growth rate: 0.0778

Initial tariff used for evaluation: \$129.03/m³

Initial water consumption amount: 1,805,140 m³

(4) Costs

Periodic costs: \$469,861,000

See Table F, A.2 of SOCIO-ECONOMIC ANNEX for calculation details.

Non-periodic costs:

Year	Amount
1996	\$688,073,000
1997	\$5,225,071,000
1998	\$20,123,170,000

See Table F, A.3 of SOCIO-ECONOMIC ANNEX for calculation details.

Variable cost: \$112/m³

See Table F, A.4 of SOCIO-ECONOMIC ANNEX for calculation details.

2) Results

The SIMOP program has given the following results:

Present Value of Benefits (10³Peso\$)

Group 1	\$3,462,966
Group 2	\$990,532
Group 3	\$11,738,120
Group 4	\$2,382,222
Total	\$18,573,840

Present Value of Costs (10³Peso\$)

Periodic	\$2,145,555
Non-periodic	\$15,228,810
Variable	\$2,773,910
Total	\$20,148,270

Net Present Value (NPV) : \$-1,574,437 x (10³Peso\$)

Benefit/Cost Ratio : 0.92

Economic Internal Rate of Return (EIRR) : 11.36

The indicators of socio-economic profitability determined by the SIMOP program shows that the project for Arica City is considered profitable as the NPV is nearly zero and the EIRR is 11.36% which is almost equal to the one requested by MIDEPLAN (12%).

Table F, A.5 of SOCIO-ECONOMIC ANNEX shows the SIMOP program results in detail.

3) Sensitivity Analysis

Sensitivity analysis was performed by varying the following variables:

The first variable sensibilized was the non-periodic costs. The sensibility analysis shows that in order to make the NPV positive and the EIRR greater than 12%, the non-periodic costs need to be decreased by at least 10.35%. With a decrease of 10.35%, the NPV is \$0 and the EIRR is 12.00%.

Variation of Non-periodic Costs:

Variation %	NPV(10 ³ Peso\$)	EIRR
-17%	1,050,000	12.49%
-14%	525,000	12.25%
-10.352025%	0	12.00%
-7%	-525,000	11.79%
-3%	-1,050,000	11.57%

The second variable was the social rate of discount. The project is profitable when the rate is 11.35%. NPV and EIRR are \$ 0 and 12 % respectively. This shows that the project is sensible to the social rate of discount as it needs a relatively small change in the rate to make the project profitable from the point of view of making the NPV positive.

Variation of Social Discount Rate Level

Social Discount Rate	NPV (10 ³ Peso\$)
9%	8,979,372
10%	4,427,189
11.3545410%	0

12%	-1,576,491
13%	-3,502,397

See Table F, A.5 of SOCIO-ECONOMIC ANNEX shows in detail the SIMOP program results for the sensitivity analysis.

Figs. F,4.3 and F,4.4 graphically show the results of the sensitivity analysis.

4.6.2 Iquique City (Stage I)

The water supply project for Iquique city will be implemented in two (2) stages. Stage I project targets the year of 2005 and Stage II project targets 2015. In this Section, the socio-economic evaluation of Stage I project is discussed.

1) Data required:

- (1) Period of evaluation: 1993-2028
- (2) Water consumption capacity of the system

With-out Project Situation

Year	Thousand M ³
1993	12,920.30
1994	12,973.91
1995	13,027.52
1996	13,081.13
1997	13,295.58
1998	13,724.47
1999	13,938.91
2000	14,153.36
2001	14,367.80
2002	14,582.25
2003	14,796.69
2004-2028	15,011.14

With Project Situation (Additional Water Supply)

Year	Thousand M ³
1999	4,478.11
2000	4,746.17
2001	5,029.99

2002	5,320.12
2003	5,553.49
2004	5,938.23
2005-2028	6,275.66

See Table F, A.6 of SOCIO-ECONOMIC ANNEX for details.

(3) Consumers groups and characteristics:

Group 1: Residential consumption between 1 - 20 m³ (Low-income class)

Price elasticity: -0.52

Demand curve type: 3

Demand growth rate: 0.0468

Initial tariff used for evaluation: \$172.01/m³

Initial water consumption amount: 4,781,000 m³

Group 2: Residential consumption between 20-30 m³ (Mid-income class)

Price elasticity: -0.2

Demand curve type: 2

Demand growth rate: 0.0468

Initial tariff used for evaluation: \$172.01/m³

Initial water consumption amount: 1,421,000 m³

Group 3: Residential consumption greater than 30m³ (High-income class)

Price elasticity: -0.25

Demand curve type: 2

Demand growth rate: 0.0889

Initial tariff used for evaluation: \$220.42/m³

Initial water consumption amount: 4,393,000 m³

Group 4: Commercial, industrial, and fiscal consumption

Price elasticity: -0.20

Demand curve type: 1

Demand growth rate: 0.0936

Initial tariff used for evaluation: \$220.42/m³

Initial water consumption amount: 2,325,300 m³

(4) Costs

Periodic costs: \$367,231,000

See Table F, A.7 of SOCIO-ECONOMIC ANNEX for calculation details.

Non-periodic costs:

Year	Amount
1996	\$552,511,000
1997	\$9,026,071,000
1998	\$9,320,702,000

See Table F, A.8 of SOCIO-ECONOMIC ANNEX for calculation details.

Variable cost: \$40.32/m³

See Table F, A.9 of SOCIO-ECONOMIC ANNEX for calculation details.

2) Results

The SIMOP program has given the following results:

Present Value of Benefits (10³Peso\$)

Group 1	\$3,911,323
Group 2	\$1,565,281
Group 3	\$11,671,200
Group 4	\$3,720,321
Total	\$20,868,120

Present Value of Costs (10³Peso\$)

Periodic	\$1,678,513
Non-periodic	\$11,418,310
Variable	\$1,041,130
Total	\$14,137,960

Net Present Value (NPV) : \$6,730,165 x (10³Peso\$)

Benefit/Cost Ratio : 1.48

Economic Internal Rate of Return (EIRR) : 17.33%

The indicators of socio-economic profitability determined by the SIMOP program shows that the project for Iquique City (Stage I) is profitable as the NPV is greater than zero and the EIRR is 17.33% which is greater than the one requested by MIDEPLAN (12%).

The SIMOP program also indicates that the optimal time to execute the project from the socio-economic point of view is 1996.

Table F, A.10 of SOCIO-ECONOMIC ANNEX shows the SIMOP program results in detail.

3) Sensitivity Analysis

Sensitivity analysis was performed by varying the following variables.

The first variable sensibilized was the non-periodic costs. For an increased by 58.94%, the project is still profitable. This shows that for the Iquique City project, it is robust enough to sustain an increase of almost half of these costs.

Variation of Non-periodic Costs:

Variation %	NPV (10 ³ Peso\$)	EIRR
-59%	13,460,330	31.99%
0%	6,730,165	17.33%
58.941855%	0	12.00%
118%	-6,730,165	9.00%
177%	-13,460,330	6.97%

The second variable was the social rate of discount. The project is still profitable for an increase up to 23.22% which is 11 points above the 12% used by MIDEPLAN. NPV and EIRR are \$ 0 and 12.00 % respectively. Therefore, it is considered that as the project is robust enough, the rate of discount will not affect it very decisively.

Variation of Social Discount Rate Level

Social Discount Rate	NPV (10 ³ Peso\$)
21%	2,584,776
22%	1,259,045
23.222999%	0
24%	-634,338
25%	-1,299,232

See Table F, A.10 of SOCIO-ECONOMIC ANNEX shows in detail the SIMOP program results for the sensitivity analysis.

Figs. F, 4.5 and 4.6 graphically show the results of the sensitivity analysis.

4.6.3 Iquique City (Stage I + Stage II)

In this Section, the socio-economic evaluation of the entire water supply Project for Iquique city targeting the year of 2015 (Stage I + Stage II) is discussed.

1) Input Data

- (1) Period of evaluation: 1993-2028
- (2) Water consumption capacity of the system

With-out Project Situation

Year	Thousand M ³
1993	12,920.30
1994	12,973.91
1995	13,027.52
1996	13,081.13
1997	13,295.58
1998	13,724.47
1999	13,938.91
2000	14,153.36
2001	14,367.80
2002	14,582.25
2003	14,796.69
2004-2028	15,011.14

With Project Situation (Additional Water Supply)

Year	Thousand M ³
1999	4,478.11
2000	4,746.17
2001	5,029.99
2002	5,320.12
2003	5,553.49
2004	5,938.22
2005	6,266.20
2006	6,764.47
2007	7,281.66
2008	7,811.47
2009	8,350.73
2010	8,908.92
2011	9,473.41
2012	10,056.83
2013	10,656.01
2014-2028	11,901.69

See Table F, A.11 of SOCIO-ECONOMIC ANNEX for details.

(3) Consumers groups and characteristics:

Group 1: Residential consumption between 1 - 20 m³ (Low-income class)

Price elasticity: -0.52

Demand curve type: 3

Demand growth rate: 0.0468

Initial tariff used for evaluation: \$172.01/m³

Initial water consumption amount: 4,781,000 m³

Group 2: Residential consumption between 20-30 m³ (Mid-income class)

Price elasticity: -0.2

Demand curve type: 2

Demand growth rate: 0.0468

Initial tariff used for evaluation: \$172.01/m³

Initial water consumption amount: 1,421,000 m³

Group 3: Residential consumption greater than 30 m³ (High-income class)

Price elasticity: -0.25

Demand curve type: 2

Demand growth rate: 0.0889

Initial tariff used for evaluation: \$220.42/m³

Initial water consumption amount: 4,393,000 m³

Group 4: Commercial, industrial, and fiscal consumption

Price elasticity: -0.20

Demand curve type: 1

Demand growth rate: 0.0936

Initial tariff used for evaluation: \$220.42/m³

Initial water consumption amount: 2,325,300 m³

(4) Costs

Periodic costs: \$714,216,000

See Table F, A.12 of SOCIO-ECONOMIC ANNEX for calculation details.

Non-periodic costs:

Year	Amount
1996	\$552,511,000
1997	\$9,026,071,000
1998	\$9,320,702,000
2003	\$465,291,000
2004	\$8,753,674,000
2005	\$8,753,674,000

See Table F, A.13 of SOCIO-ECONOMIC ANNEX for calculation details.

Variable cost: \$40.24

See Table F, A.14 of SOCIO-ECONOMIC ANNEX for calculation details.

2) Results

The SIMOP program has given the following results:

Present Value of Benefits (10^3 Peso\$)

Group 1	\$11,189,540
Group 2	\$2,784,339
Group 3	\$48,706,210
Group 4	\$6,462,477
Total	\$69,142,570

Present Value of Costs (10^3 Peso\$)

Periodic	\$3,264,487
Non-periodic	\$16,331,450
Variable	\$1,305,472
Total	\$20,901,400

Net Present Value (NPV) : \$48,241,160 x (10^3 Peso\$)

Benefit/Cost Ratio : 3.31

Economic Internal Rate of Return (EIRR) : 23.23%

The indicators of socio-economic profitability determined by the SIMOP program shows that the project for Iquique City (Stage I+II) is profitable as the NPV is greater than zero and the EIRR is 23.23% which is greater than the one requested by MIDEPLAN (12%).

The SIMOP program also indicates that the optimal time to execute the project from the socio-economic point of view is the year 2004.

Table F, A.15 of SOCIO-ECONOMIC ANNEX shows the SIMOP program results in detail.

3) Sensitivity Analysis

Sensitivity analysis was performed by varying the following variables.

The first variable sensibilized was the non-periodic costs. For an increase of 2.95 times of the original costs, the project is still profitable. This fact shows that the project is very robust so it can withstand such an increase in costs.

Variation of Non-periodic Costs:

Variation %	NPV (10 ³ Peso\$)	EIRR
0%	48,241,160	23.20%
148%	24,120,580	15.32%
295%	0	12.00%
443%	-24,120,580	9.96%
591%	-48,241,160	5.91%

The second variable was the social rate of discount. The project is profitable for a increase up to 17.32%.

Variation of Social Discount Rate Level

Social Discount Rate	NPV (10 ³ Peso\$)
15%	2,115,060
16%	1,086,311
17.3191999%	0
18%	-461,337
19%	-1,037,066

The analysis indicates that the present project (Iquique Stage I+II) is more attractive than the Iquique Stage I project from the social-economic point of view.

See Table F, A-15 of SOCIO-ECONOMIC ANNEX shows in detail the SIMOP program results for the sensitivity analysis.

Figs. F,4.7 and 4.8 graphically show the result of the sensitivity analysis.

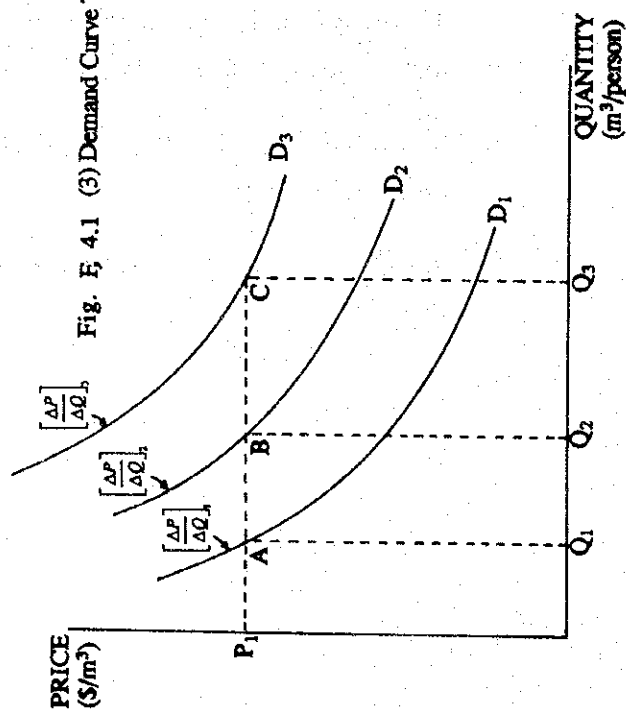
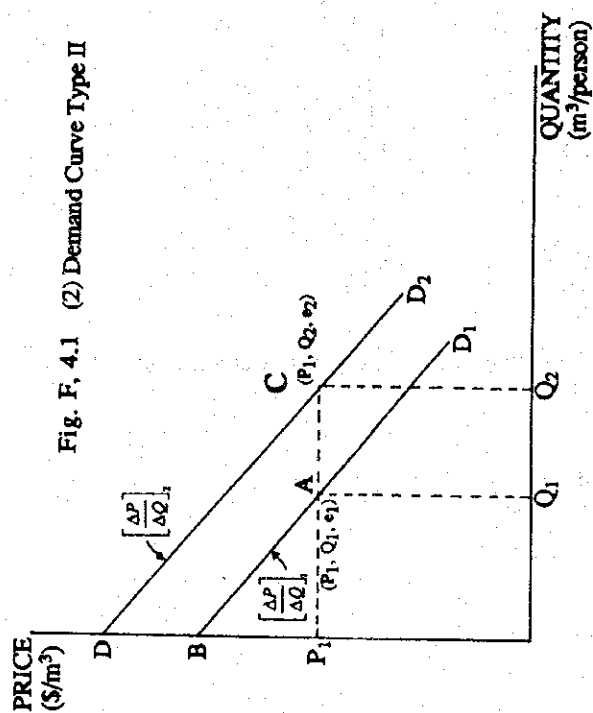
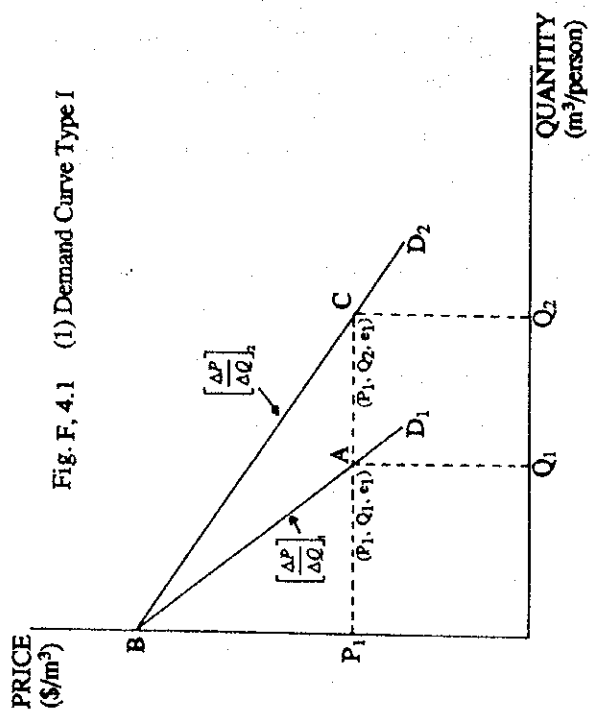
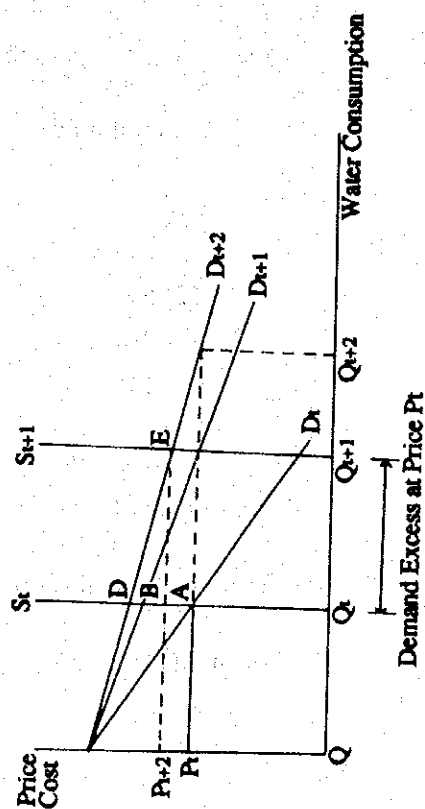


Fig. F. 4.1 (3) Demand Curve Type III

Fig. F. 4.2 Economic Benefit of Additional Water Consumption



Demand Type Curves and Economic Benefit of Additional Water Consumption
 <Curva de Demanda Tipos y Beneficio Económico por Consumo de Agua Adicional>

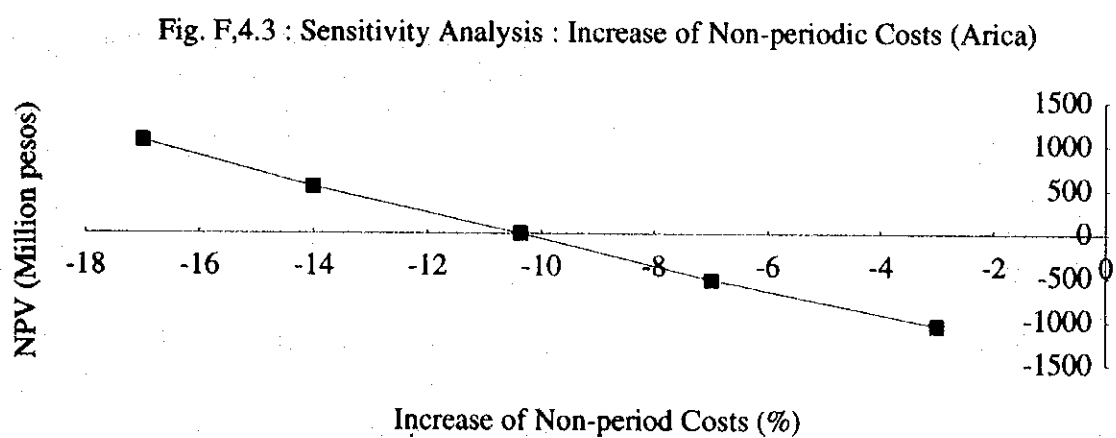


Fig. F.4.3 : Sensitivity Analysis : Increase of Non periodic Costs (Arica)
 <Análisis de Sensibilidad : Incremento de Costos No periódicos (Arica)>

Fig. F.4.4: Sensitivity Analysis : Variation of Social Discount Rate (Arica)

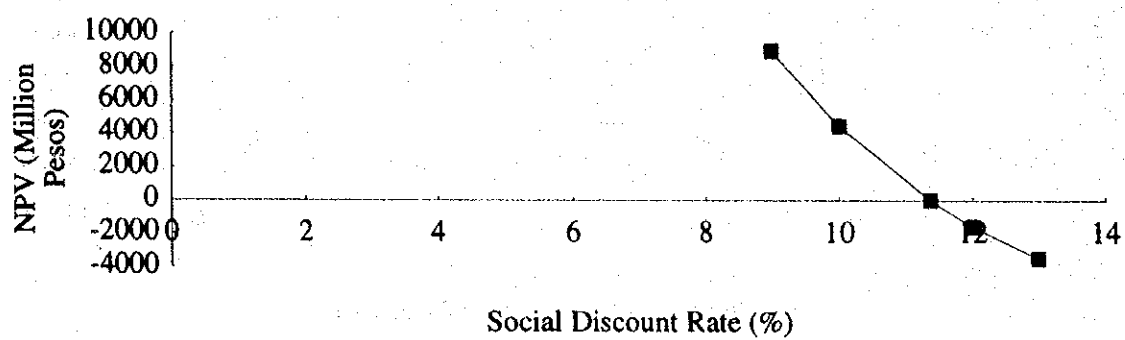


Fig. F.4.4 : Sensitivity Analysis : Variation of Social Discount Rate (Arica)
 <Análisis de Sensibilidad : Variación de la Tasa Social de Descuento (Arica)>

Fig.F,4.5 : Sensitivity Analysis : Increase of Non-periodic Costs (Iquique Stage I)

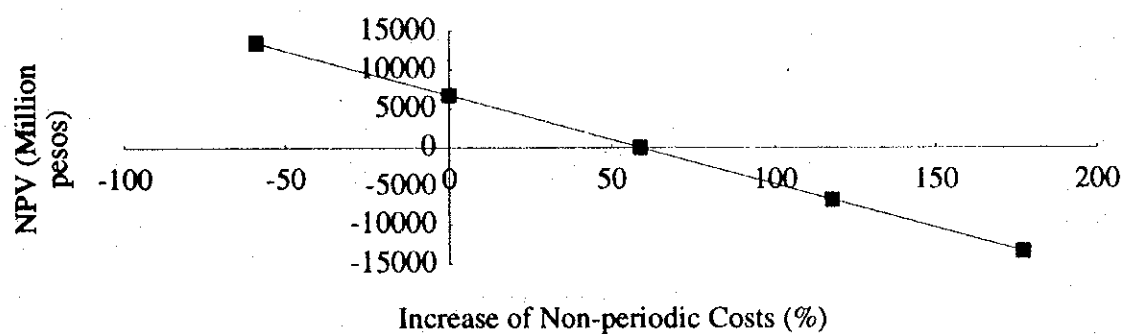


Fig. F.4.5 : Sensitivity Analysis : Increase of Non periodic Costs (Iquique Stage I)
<Análisis de Sensibilidad : Incremento de Costos No periódicos (Iquique Etapa I)>

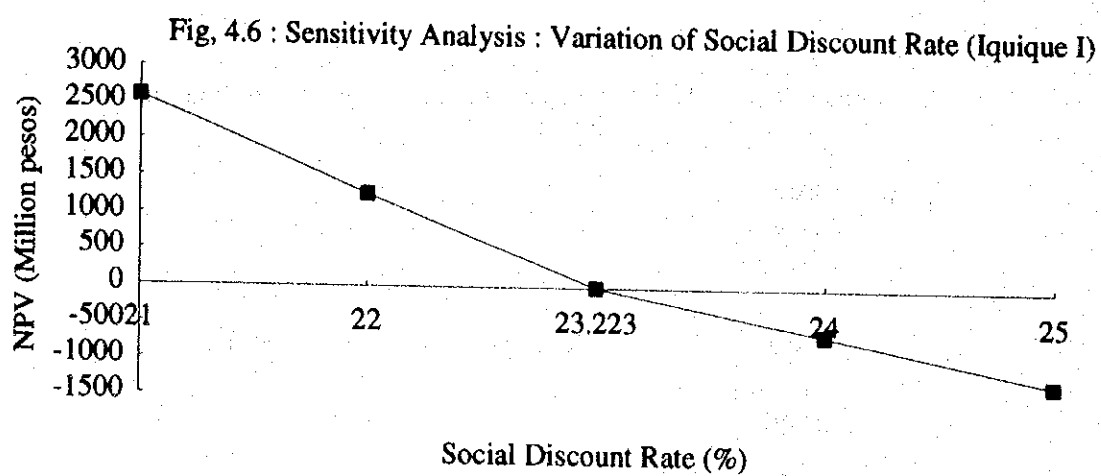


Fig. F.4.6 : Sensitivity Analysis : Variation of Social Discount Rate (Iquique Stage I)
 <Análisis de Sensibilidad : Variación de la Tasa Social de Descuento (Iquique Etapa I)>

Fig. F.4.7 : Sensitivity Analysis : Increase of Non-periodic Costs (Iquique I+II)

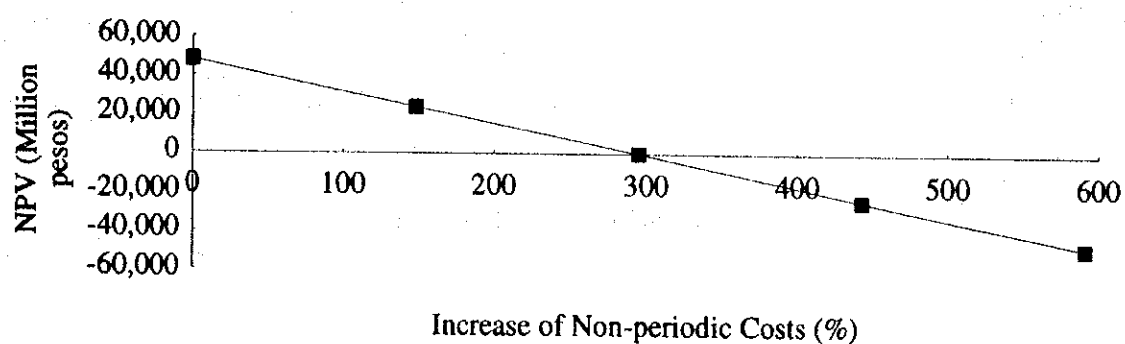


Fig. F.4.7 : Sensitivity Analysis : Increase of Non periodic Costs (Iquique Stage II)
 <Análisis de Sensibilidad : Incremento de Costos No periódicos (Iquique Etapa II)>

Fig. F.4.8 : Sensitivity Analysis : Variation of Social Discount Rate
(Iquique I+II)

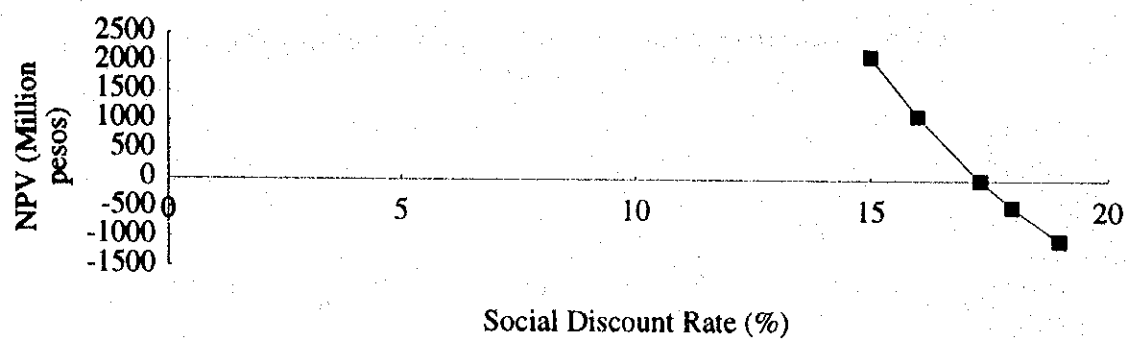


Fig. F.4.8 : Sensitivity Analysis : Variation of Social Discount Rate (Iquique Stage II)
<Análisis de Sensibilidad : Variación de la Tasa Social de Descuento (Iquique Etapa II)>

Chapter V FINANCIAL ANALYSIS

5.1 Introduction

A standard financial analysis is performed for three cases: Arica, Iquique (Stage I), and Iquique (Stage I + II).

The financial aspects are evaluated by using the Net Present Value (NPV) and the Financial Internal Rate of Return (FIRR). Apart from using those indexes, a financial statement is prepared to make an income analysis for each one of the three cases mentioned above.

5.2 Analysis Results

5.2.1 Arica City

1) Assumptions and Conditions:

- (1) The period of evaluation is 33 years (1996 - 2028).
- (2) The annual price escalation for commodities and services procured for the project is assumed to be 8%. Water tariff is considered to increase a 16% per year. The price and tariff escalation rates have been adopted based on recent trends for these costs.
- (3) The average tariff rate for Arica is estimated to be \$154/m³ at the end of 1994 according to ESSAT advice.
- (4) The investment costs and the implementation schedule are shown in Table F, 5.1. Costs include price escalation.
- (5) Revenues and operation and maintenance costs are shown in Table F, 5.2. Costs include price escalation.
- (6) The cost of opportunity of capital is 12% for the present project.
- (7) A loan covering all the investment costs is considered to implement the project.

The loan conditions are as follows:

Rate of interest : 5%
 Period of repayment : 25 years
 Period of grace : 5 years

- (8) Income tax is considered to be 25%.

2) Results of Financial Analysis

Table F, 5.3 shows the results of the cash flow analysis of the Arica City project. The NPV is \$7,199,009,275 and the FIRR is 13.06%. The indexes demonstrates the profitability of the project. It must be noted that the even though the FIRR is higher than the cost of opportunity of capital, it is still relatively low.

The financial statement shown in Table F, 5.4 indicates that with the exception of some years after the start up of the project, the profitability of the project is high enough to cover the running costs and to repay the loan within the evaluation period.

3) Results of Sensitivity Analysis

Three variables have been subject to changes to perform a sensitivity analysis: investment amount, and revenues.

The results are shown below:

Increase of Investment Costs:

Increase %	NPV (Peso\$)	FIRR
40%	-5,618,555,068	11.32%
30%	-2,414,163,982	11.69%
22.46%	0	12.00%
20%	790,227,104	12.10%
15%	2,392,422,646	12.63%

Decrease of Expected Revenues

Decrease %	NPV (Peso\$)	FIRR
-20%	-7,814,313,267	10.71%
-15%	-4,060,982,631	11.35%
-9.59	0	12.00%
-5%	3,445,678,640	12.52%
-3%	4,947,010,894	12.74%

The project is still profitable if investment costs increase by 22.46%; revenues decrease by 9.59%. For the increase of investment costs by 22.46%, NPV and FIRR are \$0 and 12.00 % respectively. For the decrease of revenue by 9.59%, NPV and FIRR are \$0 and 12.00 % respectively. Revenues is the most sensitive variable.

4) Conclusions

Arica has been suffering from a water deficit for a certain time which makes it urgent the increase of water supply for social reasons. The present project would contribute to alleviate this problem but it must be pointed out that the water resources volume coming from the Lower Lluta water source may only satisfy the projected water demand for a relatively short time. Although the tariff increase needed to finance the project would seem to be high (16% annually), it may not be a heavy burden for the users in the sense that it is lower than the historical trend for tariff increase (20% annually, in average). Also, according to consultations with MIDEPLAN, the proportion of water expenses in the family budget would not be increased even with tariff changes considered by the project.

5.2.2 Iquique City (Stage I)

1) Assumptions and Conditions:

- (1) The period of evaluation is 33 years (1996 - 2028).
- (2) The annual price escalation for commodities and services procured for the project is assumed to be 8%. Water tariff is considered to increase a 11% per year. The price and tariff escalation rates have been adopted based on recent trends for these costs.
- (3) The average tariff rate for Iquique is estimated to be \$278/m³ at the end of 1994 according to ESSAT advice.
- (4) The investment costs and the implementation schedule are shown in Table F, 5.5. Costs include price escalation.
- (5) Revenues and operation and maintenance costs are shown in Table F, 5.6. Costs include price escalation.
- (6) The cost of opportunity of capital is 12% for the present project.
- (7) A loan covering all the investment costs is considered to implement the project.

The loan conditions are as follows:

Rate of interest : 5%
Period of repayment : 25 years
Period of grace : 5 years

(8) Income tax is considered to be 25%.

2) Results of Financial Analysis

Table F, 5.7 shows the results of the cash flow analysis of the Iquique City Stage I Project. The NPV is \$11,455,886,612 and the FIRR is 14.86%. The indexes demonstrates the profitability of the project.

The financial statement shown in Table F, 5.8 indicates that with the exception of some years after the start up of the project, the profitability of the project is high enough to cover the running costs and to repay the loan within the evaluation period.

3) Results of Sensibility Analysis

Three variables have been subject to changes to perform a sensitivity analysis: investment amount,, and revenues.

The results are shown below:

Increase of Investment Costs:

Increase	NPV (Peso\$)	FIRR
60%	-2,884,940,401	11.47%
50%	-494,802,566	11.91%
47.93%	0	12.00%
40%	1,864,816,479	12.39%
30%	4,285,473,105	12.90%

Decrease of Expected Revenues

Decrease	NPV (Peso\$)	FIRR
-30%	-2,764,087,441	11.20%
-25%	-394,091,766	11.89%
-24.17%	0	12.00%
-20%	1,975,903,910	12.54%
-15%	4,345,899,585	13.16%

The project is still profitable if investment costs increase by 47.93%; revenues decrease by 24.17%. For the increase of investment costs by 47.93%, NPV and FIRR are \$ 0 and 12.00 % respectively. For the decrease of investment costs by

24.17%, NPV and FIRR are \$ 0 and 12.00% respectively. Revenues is the most sensitive variable.

4) Conclusions

The project is profitable from the financial point of view. The tariff increase (11%) is reasonable if the historically trend for tariff increase (on average 20% annually) is considered. This tariff increase will not represent a heavy burden for the household budget for the same reasons explained for the Arica project.

5.2.3 Iquique City (Stage I + II)

1) Assumptions and Conditions:

- (1) The period of evaluation is 33 years (1996 - 2028).
- (2) The annual price escalation for commodities and services procured for the project is assumed to be 8%. Water tariff is considered to increase a 11% per year. The price and tariff escalation rates have been adopted based on recent trends for these costs.
- (3) The average tariff rate for Iquique is estimated to be \$278/m³ by the end of 1994 according to ESSAT advice.
- (4) The investment costs and the implementation schedule are shown in Table F, 5.9. Costs include price escalation.
- (5) Revenues and operation and maintenance costs are shown in Table F, 5.10. Costs include price escalation.
- (6) The cost of opportunity of capital is 12% for the present project.
- (7) A loan covering all the investment costs is considered to implement the project.

The loan conditions are as follows:

Rate of interest : 5%

Period of repayment : 25 years

Period of grace : 5 years

- (8) Income tax is considered to be 25%.

2) Results of Financial Analysis

Table F, 5.11 shows the results of the cash flow analysis of the Iquique City Stage I+II Project. The NPV is \$15,428,291,810 and the FIRR is 14.31%. The indexes demonstrates the profitability of the project.

The financial statement shown in Table F, 5.12 indicates that with the exception of some years after the start up of the project, the profitability of the project is high enough to cover the running costs and to repay the loan within the evaluation period.

3) Results of Sensitivity Analysis

Three variables have been subject to changes to perform a sensibility analysis: investment amount, and revenues.

The results are shown below:

Increase of Investment Costs:

Increase %	NPV (Peso\$)	FIRR
45%	-2,986,647,957	11.64%
40%	940,534,650	11.89%
37.70%	0	12.00%
35%	1,105,568,658	12.14%
30%	3,151,671,965	12.40%

Decrease of Expected Revenues

Decrease %	NPV (Peso\$)	FIRR
-30%	-7,70,288,083	10.64%
-25%	-3,846,358,101	11.34%
-20.01%	0	12.00%
-15%	3,863,501,863	12.62%
-10%	7,718,431,845	13.21%

The project is still profitable if investment costs increase by 37.70%; revenues decrease by 20.01%. For the increase of investment costs by 37.70%, NPV and FIRR are \$ 0 and 12.00 % respectively. For the decrease of investment costs by 20.01%, NPV and FIRR are \$0 and 12.00 % respectively. Revenues is the most sensitive variable.

4) Conclusions

The Iquique Stage I + II project has a lower FIRR slightly lower than the FIRR for Iquique Stage I project (14.31% compared to 14.86%) making the latter more attractive from the financial point of view. However, the EIRR for the Iquique Stage I + II project is higher than the EIRR for the Iquique Stage I project (23.24% compared to 17.36%). The socio-economic benefits coming from the Iquique Stage I + II project may outweigh the relative financial attractiveness of Iquique Stage I, considering the fact that the tariff increase rate assumed for both projects is the same. Therefore, it is recommended to implement the Stage II project after completion of the Stage I project according to the proposed implementation schedule.

Table F, 5.1 : Investment Costs and Implementation Schedule (Arica)
 <Costos de Inversion y Calendario de Implementacion (Arica)>

(Unit : Thousand Peso)

Item	Year	
Initial Costs		
i) Land Acquisition	1996	13,996.80
ii) Detailed Design (3% of construction cost)	1996	875,748.56
Construction Costs		
iii) Intake works	1997	3,030,695.75
	1998	3,273,151.41
iv) Transmission facilities	1997	477,243.15
	1998	515,422.60
v) Treatment plant	1997	1,725,028.20
	1998	21,247,886.65
vi) Distribution network	1997	1,456,519.33
	1998	1,573,040.87
vii) Electric works	1997	0.00
	1998	214,957.26
Other		
viii) Compensation Works	1997	1,826,582.40
	1998	1,972,708.99
ix) Engineering cost (3% of construction costs)	1997	472,904.22
	1998	510,736.56
x) Administration cost (3% of construction costs)	1996	291,916.19
	1997	315,269.48
	1998	340,491.04
xi) Physical contingency (10% of construction costs)	1997	1,576,347.41
	1998	1,702,455.21
Total	1996	1,181,661.55
	1997	10,880,589.95
	1998	31,350,850.60

Table F, 5.2.: Revenues and Operation and Maintenance Costs (Arica)
<Ingresos y Costos de Operación y Mantenimiento (Arica)>

Year	Tariff (Peso/M3)	Consumption (M3/Year)	Revenue (Peso)	Electric Energy (Peso)	Chemicals (Peso)	Repair & Replace (Peso)	Personnel (Peso)	Total O & M (Peso)
1999	323	6,439,651	2,082,922,022	786,344,715	269,781,722	607,438,954	82,940,631	1,746,506,022
2000	375	6,540,566	2,454,053,437	859,452,720	294,244,139	656,034,070	89,575,882	1,899,306,810
2001	435	6,654,096	2,896,114,364	954,449,301	327,328,978	708,516,795	96,741,952	2,087,037,027
2002	505	6,748,704	3,407,257,961	1,039,468,751	363,245,074	765,198,139	104,481,309	2,292,393,272
2003	586	6,843,312	4,007,826,981	1,175,182,836	399,059,926	826,413,990	112,839,813	2,513,496,566
2004	679	6,937,920	4,713,352,284	1,269,197,463	430,984,721	892,527,109	121,866,998	2,714,576,291
2005	788	7,032,528	5,542,045,313	1,370,733,260	465,463,498	963,929,278	131,616,358	2,931,742,395
2006	914	7,032,528	6,428,772,563	1,480,391,921	502,700,578	1,041,043,620	142,145,667	3,166,281,786
2007	1,060	7,032,528	7,457,376,173	1,598,823,275	542,916,624	1,124,327,110	153,517,320	3,419,584,329
2008	1,230	7,032,528	8,650,556,360	1,726,729,137	586,349,954	1,214,273,279	165,798,706	3,693,151,075
2009	1,427	7,032,528	10,034,645,378	1,864,867,468	633,257,951	24,785,847,246	179,062,602	27,463,035,267
2010	1,655	7,032,528	11,640,188,638	2,014,056,865	683,918,587	1,416,328,352	193,387,610	4,307,691,414
2011	1,920	7,032,528	13,502,618,820	2,175,181,414	738,632,073	1,529,634,621	208,858,619	4,652,306,727
2012	2,227	7,032,528	15,663,037,832	2,349,195,927	797,722,639	1,652,005,390	225,567,309	5,024,491,266
2013	2,584	7,032,528	18,169,123,885	2,537,131,601	861,540,450	1,784,165,821	243,612,693	5,426,450,567
2014	2,997	7,032,528	21,076,183,706	2,740,102,130	930,463,687	13,628,036,237	263,101,709	17,561,703,762
2015	3,476	7,032,528	24,448,373,099	2,959,310,300	1,004,900,781	2,081,051,014	284,149,846	6,329,411,941
2016	4,033	7,032,528	28,360,112,795	3,196,055,124	1,085,292,844	2,247,535,095	306,881,833	6,835,764,896
2017	4,678	7,032,528	32,897,730,843	3,451,739,534	1,172,116,271	2,427,337,903	331,432,380	7,382,626,088
2018	5,426	7,032,528	38,161,367,777	3,727,878,697	1,265,885,573	2,621,524,935	357,946,970	7,973,236,175
2019	6,295	7,032,528	44,267,186,622	4,026,108,992	1,367,156,419	124,217,504,393	386,582,728	129,997,352,532
2020	7,302	7,032,528	51,349,936,481	4,348,197,712	1,476,528,933	3,057,746,684	417,509,346	9,299,982,675
2021	8,470	7,032,528	59,565,926,318	4,696,053,529	1,594,651,247	3,302,366,419	450,910,094	10,043,981,289
2022	9,825	7,032,528	69,096,474,529	5,071,737,811	1,722,223,347	3,566,555,733	486,982,901	10,847,499,792
2023	11,397	7,032,528	80,151,910,454	5,477,476,836	1,860,001,215	3,851,880,191	525,941,533	11,715,299,775
2024	13,221	7,032,528	92,976,216,126	5,915,674,983	2,008,801,312	4,160,030,607	568,016,856	12,652,523,757
2025	15,336	7,032,528	107,852,410,706	6,388,928,981	2,169,505,417	4,492,833,055	613,458,205	13,664,725,658
2026	17,790	7,032,528	125,108,796,419	6,900,043,300	2,343,065,850	4,852,259,699	662,534,861	14,757,903,710
2027	20,636	7,032,528	145,126,203,847	7,452,046,764	2,530,511,118	5,240,440,475	715,537,650	15,938,536,007
2028	23,938	7,032,528	168,346,396,462	8,048,210,505	2,732,952,008	5,659,675,713	772,780,662	17,213,618,888

Table F, 5.3 : Cash Flow Analysis (Arica)
 <Análisis de Flujo de Caja (Arica)>
 (Unit : Pesos)

Year	Investment	O & M Cost (*)	Total Cost	Revenue	Cash Flow
1996	1,181,661,551		1,181,661,551		-1,181,661,551
1997	10,880,589,950		10,880,589,950		-10,880,589,950
1998	31,350,850,600		31,350,850,600		-31,350,850,600
1999		1,746,506,022	1,746,506,022	2,082,922,022	336,416,000
2000		1,899,306,810	1,899,306,810	2,454,053,437	554,746,626
2001		2,087,037,027	2,087,037,027	2,896,114,364	809,077,337
2002		2,292,393,272	2,292,393,272	3,407,257,961	1,114,864,689
2003		2,513,496,566	2,513,496,566	4,007,826,981	1,494,330,415
2004		2,714,576,291	2,714,576,291	4,713,352,284	1,998,775,993
2005		2,931,742,395	2,931,742,395	5,542,045,313	2,610,302,918
2006		3,166,281,786	3,166,281,786	6,428,772,563	3,262,490,777
2007		3,419,584,329	3,419,584,329	7,457,376,173	4,037,791,844
2008		3,693,151,075	3,693,151,075	8,650,556,360	4,957,405,285
2009		27,463,035,267	27,463,035,267	10,034,645,378	-17,428,389,889
2010		4,307,691,414	4,307,691,414	11,640,188,638	7,332,497,224
2011		4,652,306,727	4,652,306,727	13,502,618,820	8,850,312,093
2012		5,024,491,266	5,024,491,266	15,663,037,832	10,638,546,566
2013		5,426,450,567	5,426,450,567	18,169,123,885	12,742,673,318
2014		17,561,703,762	17,561,703,762	21,076,183,706	3,514,479,945
2015		6,329,411,941	6,329,411,941	24,448,373,099	18,118,961,158
2016		6,835,764,896	6,835,764,896	28,360,112,795	21,524,347,899
2017		7,382,626,088	7,382,626,088	32,897,730,843	25,515,104,754
2018		7,973,236,175	7,973,236,175	38,161,367,777	30,188,131,602
2019		129,997,352,532	129,997,352,532	44,267,186,622	-85,730,165,911
2020		9,299,982,675	9,299,982,675	51,349,936,481	42,049,953,806
2021		10,043,981,289	10,043,981,289	59,565,926,318	49,521,945,029
2022		10,847,499,792	10,847,499,792	69,096,474,529	58,248,974,737
2023		11,715,299,775	11,715,299,775	80,151,910,454	68,436,610,679
2024		12,652,523,757	12,652,523,757	92,976,216,126	80,323,692,369
2025		13,664,725,658	13,664,725,658	107,852,410,706	94,187,685,049
2026		14,757,903,710	14,757,903,710	125,108,796,419	110,350,892,709
2027		15,938,536,007	15,938,536,007	145,126,203,847	129,187,667,840
2028		17,213,618,888	17,213,618,888	168,346,396,462	151,132,777,574
				NPV	7,199,009,275
				FIRR	13.06%

(*) Considering replacement costs

Table F.5.4 : Financial Statement (Arica)
<Estado Financiero (Arica)>

Year	OrdM (*)	Interest Payment	Capital Repayment	Total Expenditure	Gross Revenue	Net Revenue Before Depreciation	Depreciation	Net Revenue After Depreciation	Tax	Net Revenue After Tax	Accumulated Net Revenue
1996		59,083,078		59,083,078		-59,083,078		-59,083,078		-59,083,078	-59,083,078
1997		603,112,575		603,112,575		-603,112,575		-603,112,575		-603,112,575	-662,195,653
1998		2,170,655,105		3,917,161,127	2,082,922,022	-1,834,239,105		-3,555,045,320		-3,555,045,320	-4,217,240,972
1999	1,746,506,022	2,170,655,105		4,069,961,915	2,454,053,437	-1,615,908,479	1,720,806,215	-3,336,714,694		-3,336,714,694	-7,553,955,666
2000	1,899,306,810	2,170,655,105		6,428,347,237	2,896,114,364	-3,532,232,873	1,720,806,215	-5,253,039,088		-5,253,039,088	-12,806,994,754
2001	2,087,037,027	2,170,655,105	2,170,655,105	6,524,170,727	3,407,257,961	-3,117,912,766	1,720,806,215	-4,838,718,981		-4,838,718,981	-17,645,713,735
2002	2,292,393,272	2,062,122,350	2,170,655,105	6,637,741,265	4,007,826,981	-2,629,914,284	1,720,806,215	-4,350,720,499		-4,350,720,499	-21,996,434,234
2003	2,513,496,566	1,953,589,595	2,170,655,105	6,730,288,235	4,713,352,284	-2,016,935,952	1,720,806,215	-3,737,742,167		-3,737,742,167	-25,734,176,401
2004	2,714,576,291	1,843,056,839	2,170,655,105	6,838,921,584	5,542,043,313	-1,296,878,271	1,720,806,215	-3,017,682,486		-3,017,682,486	-28,751,858,887
2005	2,931,742,395	1,736,524,084	2,170,655,105	6,964,928,220	6,428,772,563	-536,155,657	1,720,806,215	-2,256,961,872		-2,256,961,872	-31,008,820,759
2006	3,166,281,786	1,627,991,329	2,170,655,105	7,109,698,007	7,457,376,173	347,678,165	1,720,806,215	-1,373,128,050		-1,373,128,050	-32,381,948,809
2007	3,419,584,329	1,519,458,574	2,170,655,105	7,274,731,999	8,650,556,360	1,375,824,362	1,720,806,215	-344,981,853		-344,981,853	-32,726,930,662
2008	3,693,131,075	1,410,925,818	2,170,655,105	7,461,651,329	10,034,643,378	2,572,994,049	1,720,806,215	852,187,834	213,046,958	639,140,875	-32,087,789,787
2009	3,988,603,161	1,302,393,063	2,170,655,105	7,667,206,827	11,640,188,638	3,967,981,811	1,720,806,215	2,247,175,596	561,793,899	1,685,381,697	-30,402,408,090
2010	4,307,691,414	1,193,860,308	2,170,655,105	7,908,289,385	13,502,618,820	5,594,329,664	1,720,806,215	3,873,523,221	968,380,805	2,905,142,415	-27,497,265,675
2011	4,652,306,727	1,085,327,553	2,170,655,105	8,171,941,168	15,663,037,832	7,491,096,664	1,720,806,215	5,770,290,449	1,442,572,612	4,327,717,837	-23,169,547,838
2012	5,024,491,266	976,794,797	2,170,655,105	8,465,367,714	18,169,123,885	9,703,756,171	1,720,806,215	7,982,949,956	1,995,737,489	5,987,212,467	-17,182,335,371
2013	5,426,450,567	868,262,042	2,170,655,105	8,790,951,004	21,076,183,706	12,285,232,702	1,720,806,215	10,564,426,487	2,641,106,622	7,923,319,866	-9,259,015,505
2014	5,860,566,612	759,729,287	2,170,655,105	9,151,263,578	24,448,373,099	15,297,109,522	1,720,806,215	13,576,303,307	3,394,075,827	10,182,227,480	923,211,975
2015	6,329,411,941	651,196,532	2,170,655,105	9,549,083,778	28,360,112,795	18,811,029,018	1,720,806,215	17,090,222,803	4,272,555,701	12,817,667,102	13,740,879,077
2016	6,835,764,896	542,663,776	2,170,655,105	9,987,412,214	32,897,730,843	22,910,318,628	1,720,806,215	21,189,512,413	5,297,378,103	15,892,134,310	29,633,013,387
2017	7,382,626,088	434,131,021	2,170,655,105	10,469,489,546	38,161,367,777	27,691,878,231	1,720,806,215	25,971,072,016	6,492,768,004	19,478,304,012	49,111,317,399
2018	7,973,236,175	323,598,266	2,170,655,105	10,998,815,685	44,267,186,622	33,268,370,937	1,720,806,215	31,547,564,722	7,886,891,181	23,660,673,542	72,771,990,941
2019	8,611,095,069	217,065,511	2,170,655,105	11,579,170,535	51,349,936,481	39,770,765,946	1,720,806,215	38,049,959,731	9,512,489,933	28,537,469,798	101,309,460,739
2020	9,299,982,675	108,532,755	2,170,655,105	10,043,981,289	59,565,926,318	49,521,943,029	1,720,806,215	47,801,138,814	11,950,284,704	35,850,854,111	137,160,314,850
2021	10,043,981,289			10,847,499,792	69,096,474,529	58,248,974,737	1,720,806,215	56,528,168,522	14,132,042,131	42,396,126,392	179,556,441,242
2022	11,715,299,775			11,715,299,775	80,151,910,454	68,436,610,679	1,720,806,215	66,715,804,464	16,678,951,116	50,036,853,348	229,593,294,589
2023	12,652,523,757			12,652,523,757	92,976,216,126	80,323,692,369	1,720,806,215	78,602,886,154	19,650,721,539	58,952,164,616	288,545,459,205
2024	13,664,725,658			13,664,725,658	107,852,410,706	94,187,685,049	1,720,806,215	92,466,878,834	23,116,719,708	69,350,159,125	357,895,618,330
2025	14,757,903,710			14,757,903,710	125,108,796,419	110,506,892,709	1,720,806,215	108,630,086,494	27,157,521,624	81,472,564,871	437,368,183,201
2026	15,938,536,007			15,938,536,007	145,126,203,847	129,187,667,840	1,720,806,215	127,466,861,625	31,866,715,406	95,600,146,218	534,968,329,420
2027	17,213,618,888			17,213,618,888	168,346,396,462	151,132,777,574	1,720,806,215	149,411,971,359	37,352,992,840	112,058,978,520	647,027,307,939

(*) Without considering replacement cost

Table F, 5.5 : Investment Costs and Implementation Schedule (Iquique Stage I)
<Costos de Inversion y Calendario de Implementacion (Iquique Etapa I)>

(Unit : Thousand Peso)

Item	Year	
Initial Costs		
i) Land Acquisition	1996	305,596.80
ii) Detailed Design (3% of construction cost)	1996	703,210.64
Construction Costs		
iii) Intake works	1997	1,534,985.53
	1998	1,657,784.37
iv) Transmission facilities	1997	10,541,104.99
	1998	11,384,393.39
v) Treatment plant	1997	0.00
	1998	0.00
vi) Distribution network	1997	482,183.74
	1998	520,758.44
vii) Electric works	1997	0.00
	1998	214,957.26
Other		
viii) Engineering cost (1.5% of construction costs)	1997	379,733.75
	1998	410,112.44
ix) Administration cost (1% of construction costs)	1996	234,403.55
	1997	253,155.83
	1998	273,408.30
x) Physical contingency (5% of construction costs)	1997	1,265,779.15
	1998	1,367,041.48
Total	1996	1,243,210.99
	1997	14,456,942.99
	1998	15,828,455.68

Table F. 5.6 : Revenues and Operation and Maintenance Costs (Iquique Stage I)
<Ingresos y Costos de Operación y Mantenimiento (Iquique Etapa I)>

Year	Tariff (Peso/M3)	Consumption (M3/Year)	Annual Revenue (Peso)	Electric Power (Peso)	Chemicals (Peso)	Repair & Replace (Peso)	Personnel (Peso)	Total O & M (Peso)
1999	468	4,478,112	2,095,943,391	276,254,249	6,886,320	522,656,248	16,926,659	822,723,477
2000	520	4,761,936	2,473,951,210	311,677,986	7,764,733	564,468,748	18,280,792	902,192,259
2001	577	5,045,760	2,909,759,834	351,145,454	8,747,973	609,626,247	19,743,256	989,262,930
2002	640	5,329,584	3,411,511,545	395,249,488	9,847,861	658,396,347	21,322,716	1,084,816,412
2003	711	5,553,490	3,945,867,297	438,905,454	10,934,555	711,068,055	23,028,533	1,183,936,597
2004	789	5,928,768	4,675,886,358	499,650,807	12,447,852	767,953,499	24,870,816	1,304,922,974
2005	875	6,275,664	5,493,917,753	561,185,869	13,981,729	829,389,779	26,860,481	1,431,417,858
2006	972	6,275,664	6,098,248,706	606,080,738	15,100,268	895,740,962	29,009,320	1,545,931,287
2007	1,079	6,275,664	6,769,056,063	654,567,197	16,308,289	967,400,238	31,330,065	1,669,605,790
2008	1,197	6,275,664	7,513,652,230	706,932,573	17,612,952	1,044,792,258	33,836,471	1,803,174,253
2009	1,329	6,275,664	8,340,153,976	763,487,179	19,021,988	1,128,375,638	36,543,388	1,947,428,193
2010	1,475	6,275,664	9,257,570,913	824,566,153	20,543,747	1,218,645,689	39,466,859	2,103,222,449
2011	1,637	6,275,664	10,275,903,713	890,531,445	22,187,247	1,316,137,344	42,624,208	2,271,480,245
2012	1,818	6,275,664	11,406,253,122	961,773,961	23,962,227	1,421,428,332	46,034,145	2,453,198,664
2013	2,017	6,275,664	12,660,940,965	1,038,715,878	25,879,205	1,535,142,598	49,716,876	2,649,454,558
2014	2,239	6,275,664	14,053,644,471	1,121,813,148	27,949,541	1,658,162,299	53,694,226	2,849,619,214
2015	2,486	6,275,664	15,599,545,363	1,211,558,200	30,185,505	1,790,590,025	57,989,764	3,090,323,494
2016	2,759	6,275,664	17,315,495,353	1,308,482,856	32,600,345	1,933,837,227	62,628,946	3,337,549,373
2017	3,063	6,275,664	19,220,199,842	1,413,161,485	35,208,373	2,088,544,205	67,639,261	3,604,553,323
2018	3,400	6,275,664	21,334,421,825	1,526,214,403	38,025,042	2,255,627,741	73,050,402	3,892,917,589
2019	3,773	6,275,664	23,681,208,225	1,648,311,556	41,067,046	2,441,525,778	78,894,434	4,186,798,814
2020	4,189	6,275,664	26,286,141,130	1,780,176,480	44,352,410	2,630,964,641	85,205,989	4,540,699,520
2021	4,649	6,275,664	29,177,616,655	1,922,590,599	47,900,602	2,841,441,812	92,022,468	4,903,955,481
2022	5,161	6,275,664	32,387,154,487	2,076,397,846	51,732,650	3,068,757,157	99,384,266	5,296,271,920
2023	5,728	6,275,664	35,949,741,480	2,242,509,674	55,871,263	3,314,257,730	107,335,007	5,719,973,673
2024	6,359	6,275,664	39,904,213,043	2,421,910,448	60,340,964	3,579,398,348	115,921,807	6,177,571,567
2025	7,058	6,275,664	44,293,676,478	2,615,663,284	65,168,241	3,865,750,216	125,195,552	6,671,777,293
2026	7,834	6,275,664	49,165,980,890	2,824,916,347	70,381,700	4,175,010,234	135,211,196	7,205,519,476
2027	8,696	6,275,664	54,574,238,788	3,050,909,654	76,012,236	4,509,011,052	146,028,092	7,781,961,034
2028	9,653	6,275,664	60,577,405,055	3,294,982,427	82,093,215	4,869,731,936	157,710,339	8,404,517,917

Table F, 5.7 : Cash Flow Analysis (Iquique Stage I)
<Análisis de Flujo de Caja (Iquique Etapa I)>

(Unit : Peso)

Year	Investment	O & M Cost (*)	Total Cost	Benefits	Cash Flow
1996	1,243,210,986		1,243,210,986		-1,243,210,986
1997	14,456,942,987		14,456,942,987		-14,456,942,987
1998	15,828,455,682		15,828,455,682		-15,828,455,682
1999		822,723,477	822,723,477	2,095,943,391	1,273,219,915
2000		902,192,259	902,192,259	2,473,951,210	1,571,758,951
2001		989,262,930	989,262,930	2,909,759,834	1,920,496,904
2002		1,084,816,412	1,084,816,412	3,411,511,545	2,326,695,133
2003		1,183,936,597	1,183,936,597	3,945,867,297	2,761,930,700
2004		1,304,922,974	1,304,922,974	4,675,886,358	3,370,963,384
2005		1,431,417,858	1,431,417,858	5,493,917,753	4,062,499,895
2006		1,545,931,287	1,545,931,287	6,098,248,706	4,552,317,419
2007		1,669,605,790	1,669,605,790	6,769,056,063	5,099,450,273
2008		1,803,174,253	1,803,174,253	7,513,652,230	5,710,477,977
2009		1,947,428,193	1,947,428,193	8,340,153,976	6,392,725,782
2010		2,103,222,449	2,103,222,449	9,257,570,913	7,154,348,464
2011		2,271,480,245	2,271,480,245	10,275,903,713	8,004,423,469
2012		2,453,198,664	2,453,198,664	11,406,253,122	8,953,054,457
2013		2,649,454,558	2,649,454,558	12,660,940,965	10,011,486,408
2014		2,849,619,214	2,849,619,214	14,053,644,471	11,204,025,257
2015		3,090,323,494	3,090,323,494	15,599,545,363	12,509,221,869
2016		3,337,549,373	3,337,549,373	17,315,495,353	13,977,945,980
2017		3,604,553,323	3,604,553,323	19,220,199,842	15,615,646,519
2018		3,892,917,589	3,892,917,589	21,334,421,825	17,441,504,236
2019		4,186,798,814	4,186,798,814	23,681,208,225	19,494,409,412
2020		4,540,699,520	4,540,699,520	26,286,141,130	21,745,441,610
2021		4,903,955,481	4,903,955,481	29,177,616,655	24,273,661,173
2022		5,296,271,920	5,296,271,920	32,387,154,487	27,090,882,567
2023		5,719,973,673	5,719,973,673	35,949,741,480	30,229,767,807
2024		6,177,571,567	6,177,571,567	39,904,213,043	33,726,641,476
2025		6,671,777,293	6,671,777,293	44,293,676,478	37,621,899,185
2026		7,205,519,476	7,205,519,476	49,165,980,890	41,960,461,414
2027		7,781,961,034	7,781,961,034	54,574,238,788	46,792,277,754
2028		8,404,517,917	8,404,517,917	60,577,405,055	52,172,887,138
				NPV	11,455,886,612
				FIRR	14.86%

Table F. 5.8 : Financial Statement (Iquique Stage I)
<Estado Financiero (Iquique Etapa I)>

Year	O&M (*)	Interest	Capital	Total Expenditure	Gross Revenue	Net Revenue Before Depreciation	(Unit : Peso) Depreciation	Net Revenue After Depreciation	Tax	Net Revenue After Tax	Accumulated Net Revenue
1996		62,160,549		62,160,549		-62,160,549		-62,160,549		-62,160,549	-62,160,549
1997		785,007,699		785,007,699		-785,007,699		-785,007,699		-785,007,699	-847,168,248
1998		1,576,430,483		2,398,153,960	2,095,943,391	-303,210,568	227,090,129	-530,300,697		-530,300,697	-1,377,468,945
1999	822,723,477	1,576,430,483		2,478,622,742	2,473,951,210	-4,671,532	227,090,129	-231,761,661		-231,761,661	-1,609,230,606
2000	902,192,259	1,576,430,483		4,142,123,896	2,909,759,834	-1,232,364,062	227,090,129	-1,459,454,191		-1,459,454,191	-3,068,684,797
2001	989,262,930	1,576,430,483	1,576,430,483	4,138,855,854	3,411,511,545	-727,344,309	227,090,129	-974,434,438		-974,434,438	-4,043,119,235
2002	1,084,816,412	1,497,608,959	1,576,430,483	4,179,154,515	3,945,867,297	-233,287,218	227,090,129	-460,377,347		-460,377,347	-4,503,496,582
2003	1,183,936,597	1,418,787,434	1,576,430,483	4,221,319,367	4,675,886,358	454,566,990	227,090,129	227,476,861	56,869,215	170,607,646	-4,332,888,935
2004	1,304,922,974	1,339,965,910	1,576,430,483	4,261,144,386	5,493,917,753	1,234,925,025	227,090,129	1,566,473,945	249,458,724	748,376,172	-3,584,512,763
2005	1,431,417,858	1,261,144,386	1,576,430,483	4,268,992,728	6,098,248,706	1,793,564,074	227,090,129	1,566,473,945	391,618,486	1,174,855,459	-2,409,657,305
2006	1,545,931,287	1,182,322,862	1,576,430,483	4,304,684,632	6,769,056,063	2,419,518,432	227,090,129	2,882,277,551	548,107,081	1,644,321,243	-765,336,062
2007	1,669,605,790	1,103,501,338	1,576,430,483	4,349,537,611	7,513,652,230	3,109,367,680	227,090,129	2,882,277,551	720,569,388	2,161,708,164	1,396,372,102
2008	1,803,174,253	1,024,679,814	1,576,430,483	4,404,284,550	8,340,153,976	3,870,437,010	227,090,129	3,643,346,881	910,836,720	2,732,510,160	4,128,882,262
2009	1,947,428,193	945,858,290	1,576,430,483	4,469,716,966	9,257,570,913	4,710,881,216	227,090,129	4,483,791,087	1,120,947,772	3,362,843,315	7,491,725,577
2010	2,103,222,449	867,036,765	1,576,430,483	4,546,689,697	10,275,903,713	5,639,777,744	227,090,129	5,412,687,615	1,353,171,904	4,059,515,711	11,551,241,289
2011	2,271,480,245	788,215,241	1,576,430,483	4,636,125,969	11,406,253,122	6,667,230,257	227,090,129	6,440,140,128	1,610,035,032	4,830,105,096	16,381,346,385
2012	2,433,198,664	709,393,717	1,576,430,483	4,739,022,865	12,660,940,965	7,804,483,732	227,090,129	7,577,393,603	1,894,348,401	5,683,045,202	22,064,391,587
2013	2,649,454,558	630,572,193	1,576,430,483	4,856,457,234	14,053,644,471	9,064,052,397	227,090,129	8,836,962,268	2,209,240,567	6,627,721,701	28,692,113,288
2014	2,861,410,922	551,750,669	1,576,430,483	4,989,592,074	15,599,545,363	10,459,862,242	227,090,129	10,232,772,113	2,558,193,028	7,674,579,085	36,366,692,373
2015	3,090,323,494	472,929,145	1,576,430,483	5,139,683,122	17,315,495,353	12,007,407,876	227,090,129	11,780,317,747	2,945,079,437	8,835,238,310	45,201,930,683
2016	3,337,549,373	394,107,621	1,576,430,483	5,308,087,477	19,220,199,842	13,723,929,939	227,090,129	13,496,839,810	3,374,209,953	10,122,629,858	55,324,560,541
2017	3,604,533,323	315,286,096	1,576,430,483	5,496,269,903	21,334,421,825	15,628,609,180	227,090,129	15,401,519,051	3,850,379,763	11,551,139,289	66,875,699,830
2018	3,892,917,589	236,464,572	1,576,430,483	5,705,812,644	23,681,208,225	17,742,783,698	227,090,129	17,515,693,569	4,378,923,392	13,136,770,177	80,012,470,006
2019	4,204,350,996	157,643,048	1,576,430,483	5,938,424,527	26,286,141,130	20,090,189,604	227,090,129	19,863,099,475	4,965,774,869	14,897,324,606	94,909,794,612
2020	4,540,699,520	78,821,524	1,576,430,483	6,195,951,527	29,177,616,655	24,273,661,173	227,090,129	24,046,571,044	6,011,642,761	18,034,928,283	112,944,722,896
2021	4,903,955,481			4,903,955,481	32,387,154,487	27,090,882,567	227,090,129	26,863,792,438	6,715,948,109	20,147,844,328	133,092,567,224
2022	5,296,271,920			5,296,271,920	35,949,741,480	30,229,767,807	227,090,129	30,002,677,678	7,500,669,419	22,502,008,258	155,594,575,482
2023	5,719,973,673			5,719,973,673	39,904,213,043	33,726,641,476	227,090,129	33,499,551,347	8,374,887,837	25,124,663,510	180,719,238,992
2024	6,177,571,567			6,177,571,567	44,293,676,478	37,621,899,185	227,090,129	37,394,809,056	9,348,702,264	28,046,106,792	208,765,345,784
2025	6,671,777,293			6,671,777,293	49,165,980,890	41,960,461,414	227,090,129	41,733,371,285	10,433,342,821	31,300,028,464	240,065,374,248
2026	7,205,519,476			7,205,519,476	54,574,238,788	46,792,277,754	227,090,129	46,565,187,625	11,641,296,906	34,923,890,719	274,989,264,966
2027	7,781,961,034			7,781,961,034	60,577,405,055	52,172,887,138	227,090,129	51,945,797,009	12,986,449,252	38,959,347,757	313,948,612,723
2028	8,404,517,917			8,404,517,917							

(*) Without considering replacement costs

Table F, 5.9 : Investment Costs and Implementation Schedule (Iquique : Stage I+II)
 <Costos de Inversión y Calendario de Implementación (Iquique Etapas I+II)>

(Unit : Thousand Peso)

	Year	
Costs		
Acquisition	1996	305,596.80
Feasibility Study (3% of construction cost)	1996	703,210.64
	2003	1,119,695.75
Construction Costs		
Electric works	1997	1,534,985.53
	1998	1,657,784.37
	2004	2,049,687.71
	2005	2,213,662.73
Transmission facilities	1997	10,541,104.99
	1998	11,384,393.39
	2004	16,825,694.23
	2005	18,171,749.77
Substation plant	1997	0.00
	1998	0.00
	2004	0.00
	2005	0.00
Distribution network	1997	482,183.74
	1998	520,758.44
	2004	1,279,141.47
	2005	1,381,472.79
Electric works	1997	0.00
	1998	214,957.26
Financing cost (1.5% of construction costs)	1997	379,733.75
	1998	410,112.44
	2004	604,635.70
	2005	653,006.56
Administration cost (1% of construction costs)	1996	234,403.55
	1997	253,155.83
	1998	273,408.30
	2003	373,231.92
	2004	403,090.47
	2005	435,337.71
Capital contingency (5% of construction costs)	1997	1,265,779.15
	1998	1,367,041.48
	2004	2,015,452.34
	2005	2,176,688.53
	1996	1,243,210.99
	1997	14,456,942.99
	1998	15,828,455.68
	2003	1,492,927.66
	2004	23,177,701.92
	2005	25,031,918.08

Table F. 5.10 : Revenues and Operation and Maintenance Costs (Iquique Stage I+II)
<Ingresos y Costos de Operación y Mantenimiento (Iquique Etapas I+II)>

Year	Tariff (Peso/M3)	Consumption (M3/Year)	Revenue (Peso)	Electric Power (Peso)	Chemicals (Peso)	Repair & Replace (Peso)	Personnel (Peso)	Total O & M (Peso)
1999	468	4,478,112	2,095,943,391	276,254,249	6,886,320	1,032,491,477	16,926,659	1,332,558,705
2000	520	4,761,936	2,473,951,210	311,677,986	7,764,733	1,115,090,795	18,280,792	1,452,814,306
2001	577	5,045,760	2,909,759,834	351,145,454	8,747,973	1,204,298,058	19,743,256	1,583,934,741
2002	640	5,329,584	3,411,511,545	395,249,488	9,847,861	1,300,641,903	21,322,716	1,727,061,968
2003	711	5,553,490	3,945,867,297	438,905,454	10,934,555	1,404,693,255	23,028,533	1,877,561,798
2004	789	5,928,768	4,675,886,358	499,650,807	12,447,852	1,517,068,716	24,870,816	2,054,038,190
2005	875	6,275,664	5,493,917,753	561,185,869	13,981,729	1,638,434,213	26,860,481	2,240,462,292
2006	972	6,780,240	6,590,393,280	657,345,645	16,307,471	1,769,508,950	29,009,320	2,472,171,386
2007	1,079	7,284,816	7,860,316,464	765,296,677	18,951,206	1,911,069,666	31,330,065	2,726,647,614
2008	1,197	7,820,928	9,361,650,816	886,236,495	21,956,527	2,063,955,239	33,836,471	3,005,984,731
2009	1,329	8,357,040	11,106,506,160	1,021,711,261	25,352,344	2,229,071,658	36,543,388	3,312,678,651
2010	1,475	8,924,688	13,163,914,800	1,173,190,077	29,212,208	2,407,397,391	39,466,859	3,649,266,534
2011	1,637	9,460,800	15,487,329,600	1,352,119,798	33,551,449	2,599,989,182	42,624,208	4,028,284,637
2012	2,017	10,059,984	20,290,987,728	1,552,061,966	38,462,946	2,807,988,317	46,034,145	4,444,547,373
2013	2,239	10,659,168	23,865,877,152	1,775,453,522	44,008,675	3,032,627,382	49,716,876	4,901,806,455
2014	2,486	11,258,352	27,988,263,072	2,062,137,947	50,271,303	3,537,256,578	53,694,226	5,954,421,834
2015	2,759	11,889,072	32,801,949,648	2,301,831,211	57,344,281	3,820,237,105	57,989,764	6,430,775,581
2016	3,063	11,889,072	36,416,227,536	2,485,977,708	61,931,823	4,125,856,073	67,639,261	6,945,237,628
2017	3,400	11,889,072	40,422,844,800	2,684,855,924	66,886,369	4,455,924,559	73,050,402	7,500,856,638
2018	3,773	11,889,072	44,857,468,656	2,899,644,398	72,237,279	4,877,845,930	78,894,434	8,748,999,182
2019	4,189	11,889,072	49,803,322,608	3,131,615,950	78,016,261	5,197,390,405	85,205,989	10,204,832,646
2020	4,649	11,889,072	55,272,295,728	3,382,145,226	84,257,562	5,309,490,052	92,022,468	11,145,227,531
2021	5,161	11,889,072	61,359,500,592	3,652,716,844	90,998,167	6,062,236,169	99,384,266	12,855,150,142
2022	5,728	11,889,072	68,100,604,416	3,944,934,192	98,278,020	6,547,215,062	107,335,007	14,994,247,126
2023	6,359	11,889,072	75,602,608,848	4,260,528,927	106,140,262	7,070,992,267	115,921,807	16,193,786,896
2024	7,058	11,889,072	83,913,070,176	4,601,371,241	114,631,483	7,636,671,649	125,195,552	
2025	7,058	11,889,072	83,913,070,176	4,969,480,940	123,802,002	8,907,413,811	135,211,196	
2026	7,834	11,889,072	93,138,990,048	5,367,039,415	133,706,162	9,620,006,916	146,028,092	
2027	8,696	11,889,072	103,387,370,112	5,796,402,569	144,402,655		157,710,339	
2028	9,653	11,889,072	114,765,212,016	6,260,114,774	155,954,867			

Table F, 5.11. : Cash Flow Analysis (Iquique Stage I+II)
(Analisis de Flujo de Caja (Iquique Etapas I+II))>

(Unit : Peso)				
Investment	O & M Cost (*)	Total Cost	Revenue	Cash Flow
1,243,210,986		1,243,210,986		-1,243,210,986
14,456,942,987		14,456,942,987		-14,456,942,987
15,828,455,682		15,828,455,682		-15,828,455,682
	1,332,558,705	1,332,558,705	2,095,943,391	763,384,686
	1,452,814,306	1,452,814,306	2,473,951,210	1,021,136,904
	1,583,934,741	1,583,934,741	2,909,759,834	1,325,825,093
	1,727,061,968	1,727,061,968	3,411,511,545	1,684,449,577
1,492,927,660	1,877,561,798	3,370,489,458	3,945,867,297	575,377,839
23,177,701,924	2,054,038,190	25,231,740,114	4,675,886,358	-20,555,853,757
25,031,918,078	2,240,462,292	27,272,380,370	5,493,917,753	-21,778,462,617
	2,472,171,386	2,472,171,386	6,590,393,280	4,118,221,894
	2,726,647,614	2,726,647,614	7,860,316,464	5,133,668,850
	3,005,984,731	3,005,984,731	9,361,650,816	6,355,666,085
	3,312,678,651	3,312,678,651	11,106,506,160	7,793,827,509
	3,649,266,534	3,649,266,534	13,163,914,800	9,514,648,266
	4,028,284,637	4,028,284,637	15,487,329,600	11,459,044,963
	4,444,547,373	4,444,547,373	20,290,987,728	15,846,440,355
	4,901,806,455	4,901,806,455	23,865,877,152	18,964,070,697
	11,069,549,342	11,069,549,342	27,988,263,072	16,918,713,730
	5,954,421,834	5,954,421,834	32,801,949,648	26,847,527,814
	6,430,775,581	6,430,775,581	36,416,227,536	29,985,451,955
	6,945,237,628	6,945,237,628	40,422,844,800	33,477,607,172
	7,500,856,638	7,500,856,638	44,857,468,656	37,356,612,018
	21,766,372,575	21,766,372,575	49,803,322,608	28,036,950,033
	8,748,999,182	8,748,999,182	55,272,295,728	46,523,296,546
	19,145,227,531	19,145,227,531	61,359,500,592	42,214,273,061
	10,204,832,646	10,204,832,646	68,100,604,416	57,895,771,770
	11,021,219,258	11,021,219,258	75,602,608,848	64,581,389,590
	11,902,916,799	11,902,916,799	83,913,070,176	72,010,153,377
	12,855,150,142	12,855,150,142	83,913,070,176	71,057,920,034
	23,822,113,236	23,822,113,236	93,138,990,048	69,316,876,812
	14,994,247,126	14,994,247,126	103,387,370,112	88,393,122,986
	16,193,786,896	16,193,786,896	114,765,212,016	98,571,425,120
			NPV	15,428,291,810
			FIRR	14.31%

(*) Considering replacement cost

Table F.5.12: Financial Statement (Quinto Step 1-11)

Estado Financiero (Quinto Paso 1-11)>

Year	Total O & M (*)	Interest (in Loan)	Capital (in Loan)	Interest (out Loan)	Capital (out Loan)	Total Interest	Total Capital Requirement	Total Expenditure	Gross Revenue	Net Revenue Before Depreciation	Depreciation	Net Revenue After Depreciation	Tax	Net Revenue After Tax	Accumulated Net Revenue
1996	42,160,549	783,007,699	1,576,430,482	1,576,430,482	1,576,430,482	42,160,549	783,007,699	42,160,549	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
1997	1,331,538,765	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	783,007,699	1,576,430,482	783,007,699	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
1998	1,432,314,386	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
1999	1,583,924,741	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	3,029,244,788	3,029,244,788	3,029,244,788	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2000	1,727,861,940	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	4,597,686,959	4,597,686,959	4,597,686,959	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2001	1,877,561,790	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	6,174,127,714	6,174,127,714	6,174,127,714	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2002	2,054,038,190	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	7,750,568,039	7,750,568,039	7,750,568,039	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2003	2,246,462,292	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	9,326,998,231	9,326,998,231	9,326,998,231	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2004	2,472,171,386	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	10,903,428,617	10,903,428,617	10,903,428,617	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2005	2,726,671,614	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	12,479,859,003	12,479,859,003	12,479,859,003	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2006	3,012,678,631	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	14,056,288,389	14,056,288,389	14,056,288,389	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2007	3,324,678,631	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	15,632,718,775	15,632,718,775	15,632,718,775	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2008	3,649,239,437	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	17,209,149,161	17,209,149,161	17,209,149,161	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2009	4,002,239,437	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	18,785,578,547	18,785,578,547	18,785,578,547	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2010	4,444,547,373	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	20,362,007,933	20,362,007,933	20,362,007,933	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2011	4,911,896,435	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	21,938,437,319	21,938,437,319	21,938,437,319	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2012	5,411,341,649	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	23,514,867,705	23,514,867,705	23,514,867,705	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2013	5,934,421,834	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	25,091,298,091	25,091,298,091	25,091,298,091	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2014	6,483,775,381	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	26,667,728,477	26,667,728,477	26,667,728,477	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2015	7,063,537,628	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	28,244,158,863	28,244,158,863	28,244,158,863	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2016	7,683,825,149	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	29,820,589,249	29,820,589,249	29,820,589,249	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2017	8,344,919,117	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	31,397,018,635	31,397,018,635	31,397,018,635	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2018	9,048,919,117	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	32,973,448,021	32,973,448,021	32,973,448,021	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2019	9,794,999,182	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	34,548,877,407	34,548,877,407	34,548,877,407	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2020	10,584,832,646	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	36,124,306,793	36,124,306,793	36,124,306,793	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2021	11,412,121,238	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	37,700,736,179	37,700,736,179	37,700,736,179	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2022	12,283,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	39,279,165,565	39,279,165,565	39,279,165,565	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2023	13,203,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	40,856,594,951	40,856,594,951	40,856,594,951	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2024	14,172,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	42,433,024,337	42,433,024,337	42,433,024,337	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2025	15,192,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	44,008,453,723	44,008,453,723	44,008,453,723	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2026	16,272,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	45,583,883,109	45,583,883,109	45,583,883,109	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2027	17,412,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	47,159,312,495	47,159,312,495	47,159,312,495	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549
2028	18,612,130,142	1,576,430,482	1,576,430,482	1,576,430,482	1,576,430,482	48,735,741,881	48,735,741,881	48,735,741,881	2,095,943,991	-783,007,699	793,804,999	-42,160,549	-783,007,699	-42,160,549	-42,160,549

(*) Without considering replacement costs

Fig. F,5.1 : Sensitivity Analysis : Increase of Investment Costs (Arica)

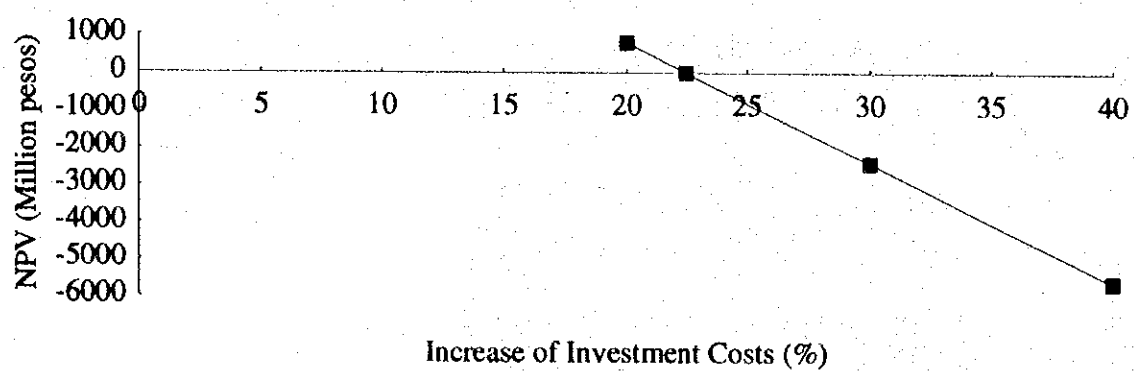


Fig. F.5.1 : Sensitivity Analysis : Increase of Investment Costs (Arica)
 <Análisis de Sensibilidad : Incremento de Costos de Inversión (Arica)>

Fig. F.5.2 : Sensitivity Analysis : Decrease of Expected Revenues (Arica)

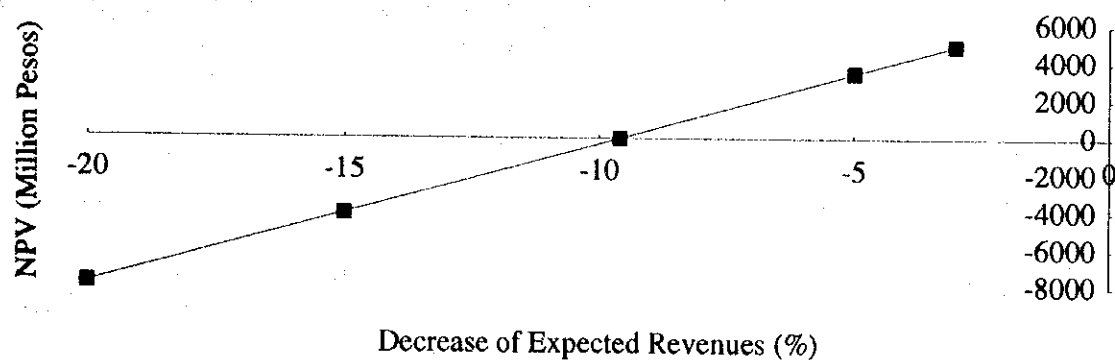


Fig. F.5.2 : Sensitivity Analysis : Decrease of Expected Revenues (Arica)
 <Análisis de Sensibilidad : Disminución de Ingresos Esperados (Arica)>

Fig.F,5.3 : Sensitivity Analysis : Increase of Investment Costs (Iquique Stage I)

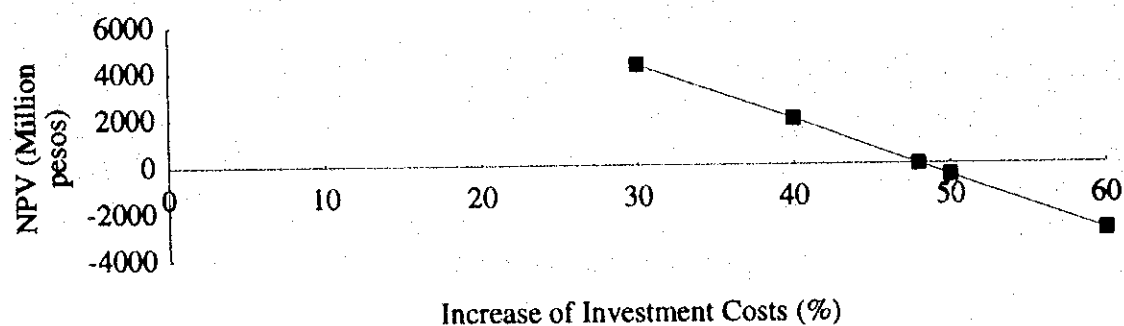


Fig. F.5.3 : Sensitivity Analysis : Increase of Investment Costs (Iquique Stage I)
<Análisis de Sensibilidad : Incremento de Costos de Inversión (Iquique Etapa I)>

Fig. F.5.4 : Sensitivity Analysis : Decrease of Expected Revenues
(Iquique I)

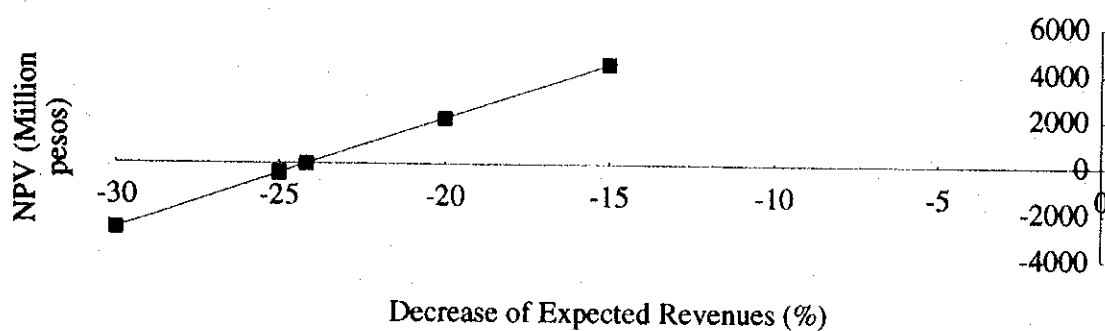


Fig. F.5.4 : Sensitivity Analysis : Decrease of Expected Revenues (Iquique Stage I)
<Análisis de Sensibilidad : Disminución de Ingresos Esperados (Iquique Etapa I)>

Fig. F.5.5 : Sensitivity Analysis : Increase of Investment Costs (Iquique I+II)

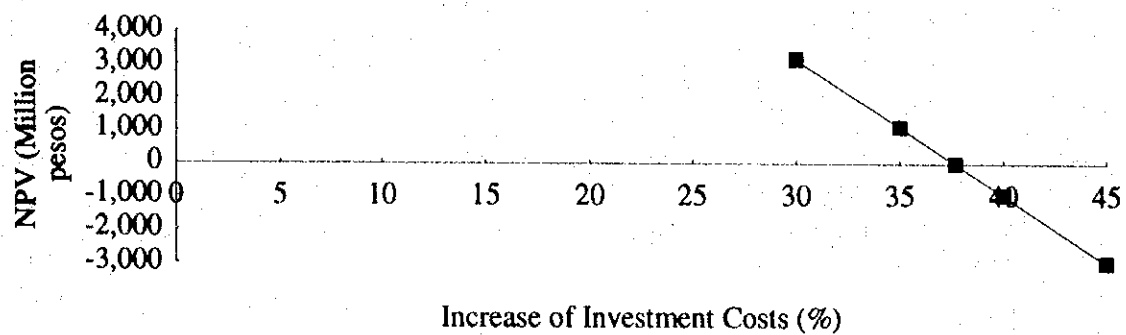


Fig. F.5.5 : Sensitivity Analysis : Increase of Investment Costs (Iquique Stage II)
 <Análisis de Sensibilidad : Incremento de Costos de Inversión (Iquique Etapa II)>

Fig. F.5.6 : Sensitivity Analysis : Decrease of Expected Revenues
(Iquique I+II)

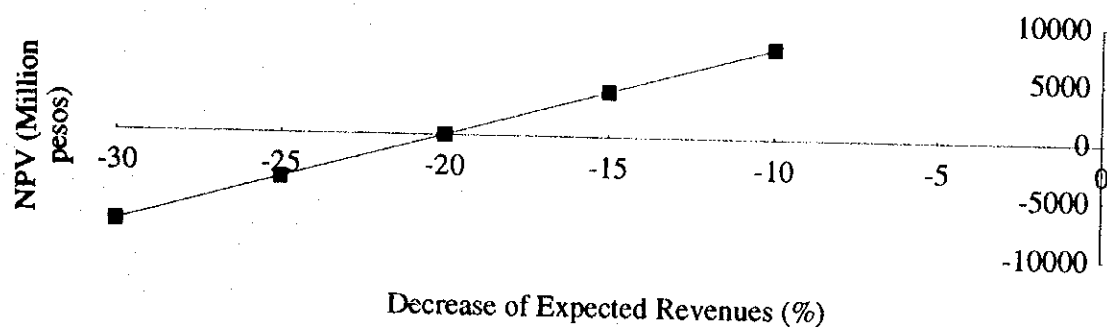


Fig. F.5.6 : Sensitivity Analysis : Decrease of Expected Revenues (Iquique Stage II)
<Análisis de Sensibilidad : Disminución de Ingresos Esperados (Iquique Etapa II)>