of 57.25%, the maximum payment of both interest payment and amortization falls on the 11th year at US$ 503,894, which is approximately 0.28% of the recurrent budget of the government of Madagascar in 1994. The details of the project loan disbursements and repayments in Case B is as per Table 12.2.5.

In Case C, where the concessionality level is high with a high grant element of 80.46%, the maximum payment of both interest payment and amortization falls on the 11th year at US$ 260,506, which is approximately 0.14% of the recurrent budget of the government of Madagascar in 1994. The details of the project loan disbursements and repayments in the Case C is per Table 12.2.6.

Figure 12.2.4 and Figure 12.2.5 illustrate the transition of the accumulated foreign loan for each case and the transition of the total payment for each case, respectively.

12.2.4 Summary and Limitations

It can be safely argued that both cost recovery analysis and the foreign loan disbursement schedule analysis verify the financial soundness of the Project.

However, the above financial evaluation has the following limitations.

1) Since the financial viability for the villages is based on the water fee of FMG 500 per month per household, which was estimated from the interview survey, the level of the water fee is not an accurate one.

2) Since the financial viability for the village is based on the collection rate of the water fee at 70% to 80%, there is a possibility that the rate will be under the figures expected.

3) The project is financially based on the well management of the government fiscal policy, and the mobilization of the recurrent budget to this sector.

Table 12.2.1 Cost Recovery Table (Hand Pump Type)

Unit : Thousand FMG

Project Year	Financial Year	O&M Cost	Replacement Cost	Cost	No. of Households	Water Charge	Revenue	Balance	Cumulative Balance
		A	B	C=A+B	D	E	F=D*E	G=F-C	
1	1996	0.0	0.0	0.0	0	4.2	0.0	0.0	0.0
2	1997	3169.3	0.0	3169.3	1398	4.2	5871.6	2702.3	2702.3
3	1998	4923.2	1551.7	6474.9	2155	4.2	9051.0	2576.1	5278.4
4	1999	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	9986.3
5	2000	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	8486.0
6	2001	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	13193.9
7	2002	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	16350.1
8	2003	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	21058.0
9	2004	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	19557.7
10	2005	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	24265.6
11	2006	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	27421.8
12	2007	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	32129.7
13	2008	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	30629.4
14	2009	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	35337.3
15	2010	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	38493.5
16	2011	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	43201.4
17	2012	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	41701.1
18	2013	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	46409.0
19	2014	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	49565.2
20	2015	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	54273.1
21	2016	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	52772.8
22	2017	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	57480.7
23	2018	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	60636.9
24	2019	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	65344.8
25	2020	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	63844.5
26	2021	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	68552.4
27	2022	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	71708.6
28	2023	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	76416.5
29	2024	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	74916.2
30	2025	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	79624.1
31	2026	7077.3	1551.7	8629.0	2806	4.2	11785.2	3156.2	82780.3
32	2027	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	87488.2
33	2028	7077.3	6208.2	13285.5	2806	4.2	11785.2	-1500.3	85987.9
34	2029	7077.3	0.0	7077.3	2806	4.2	11785.2	4707.9	90695.8
Total		227488.8	62079.2	289568.0	n.r.	n.r.	380263.8	90695.8	90695.8

Table 12.2.2 Cost Recovery Table (Generator Type)

Unit : Thousand FMG

Project Year	Financial Year	O&M Cost	Replacement Cost	Cost	No. of Households	Water Charge	Revenue	Balance	Cumulative Balance
		A	B	C=A+B	D	E	F=D*E	G=F-C	
1	1996	0.0	0.0	0.0	0	4.8	0.0	0.0	0.0
2	1997	0.0	0.0	0.0	0	4.8	0.0	0.0	0.0
3	1998	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	3666.2
4	1999	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	5535.5
5	2000	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	9201.7
6	2001	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	5678.9
7	2002	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	9345.1
8	2003	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	11214.4
9	2004	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	14880.6
10	2005	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	11357.8
11	2006	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	15024.0
12	2007	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	16893.3
13	2008	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	20559.5
14	2009	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	17036.7
15	2010	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	20702.9
16	2011	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	22572.2
17	2012	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	26238.4
18	2013	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	22715.6
19	2014	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	26381.8
20	2015	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	28251.1
21	2016	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	31917.3
22	2017	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	28394.5
23	2018	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	32060.7
24	2019	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	33930.0
25	2020	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	37596.2
26	2021	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	34073.4
27	2022	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	37739.6
28	2023	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	39608.9
29	2024	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	43275.1
30	2025	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	39752.3
31	2026	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	43418.5
32	2027	11929.0	1796.9	13725.9	3249	4.8	15595.2	1869.3	45287.8
33	2028	11929.0	0.0	11929.0	3249	4.8	15595.2	3666.2	48954.0
34	2029	11929.0	7189.0	19118.0	3249	4.8	15595.2	-3522.8	45431.2
Total		381728.0	71887.2	453615.2	n.r.	n.r.	499046.4	45431.2	45431.2

Table 12.2.3 Cost Recovery Table (Solar Type)

Unit : Thousand FMG

Project Year	Financial Year	O&M Cost	Replacement Cost	Cost	No. of Households	Water Charge	Revenue	Balance	Cumulative Balance
		A	B	C=A+B	D	E	F=D*E	G=F-C	
1	1996	0.0	0.0	0.0	0	4.2	0.0	0.0	0.0
2	1997	1253.7	0.0	1253.7	1279	4.2	5371.8	4118.1	4118.1
3	1998	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	12432.3
4	1999	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	22473.9
5	2000	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	25604.7
6	2001	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	35646.3
7	2002	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	43960.5
8	2003	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	54002.1
9	2004	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	57132.9
10	2005	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	67174.5
11	2006	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	75488.7
12	2007	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	85530.3
13	2008	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	88661.1
14	2009	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	98702.7
15	2010	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	107016.9
16	2011	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	117058.5
17	2012	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	120189.3
18	2013	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	130230.9
19	2014	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	138545.1
20	2015	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	148586.7
21	2016	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	151717.5
22	2017	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	161759.1
23	2018	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	170073.3
24	2019	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	180114.9
25	2020	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	183245.7
26	2021	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	193287.3
27	2022	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	201601.5
28	2023	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	211643.1
29	2024	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	214773.9
30	2025	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	224815.5
31	2026	3079.2	1727.4	4806.6	3124	4.2	13120.8	8314.2	233129.7
32	2027	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	243171.3
33	2028	3079.2	6910.8	9990.0	3124	4.2	13120.8	3130.8	246302.1
34	2029	3079.2	0.0	3079.2	3124	4.2	13120.8	10041.6	256343.7
Total		99788.1	69105.6	168893.7	n.r	n.r	425237.4	256343.7	256343.7

Table 12.2.4 Project Loan Disbursements and Repayments (Case A)

(Unit : US$)

Calendar Year	Project Year	Foreign Loan	Accumulated Foreign Loan	1) Interest Payment	2) Capital Payment	Total Payment
1996	1	3,551,822	3,551,822	259,993	0	259,993
1997	2	2,269,624	5,821,446	426,130	0	426,130
1998	3	597,587	6,419,033	469,873	0	469,873
1999	4	0	6,419,033	469,873	0	469,873
2000	5	0	6,419,033	469,873	0	469,873
2001	6	0	5,991,097	438,548	427,936	866,484
2002	7	0	5,563,162	407,223	427,936	835,159
2003	8	0	5,135,226	375,899	427,936	803,834
2004	9	0	4,707,291	344,574	427,936	772,509
2005	10	0	4,279,355	313,249	427,936	741,184
2006	11	0	3,851,420	281,924	427,936	709,859
2007	12	0	3,423,484	250,599	427,936	678,535
2008	13	0	2,995,549	219,274	427,936	647,210
2009	14	0	2,567,613	187,949	427,936	615,885
2010	15	0	2,139,678	156,624	427,936	584,560
2011	16	0	1,711,742	125,300	427,936	553,235
2012	17	0	1,283,807	93,975	427,936	521,910
2013	18	0	855,871	62,650	427,936	490,585
2014	19	0	427,936	31,325	427,936	459,260
2015	20	0	0	0	427,936	427,936

Notes : 1) 7.0 percent interest rate per annum

2) Grace period of 5 years, counted from the first disbursement

Table 12.2.5 Project Loan Disbursements and Repayments (Case B)

(Unit : US$)

Calendar Year	Project Year	Foreign Loan	Accumulated Foreign Loan	1) Interest Payment	2) Capital Payment	Total Payment
1996	1	3,551,822	3,551,822	106,555	0	106,555
1997	2	2,269,624	5,821,446	174,643	0	174,643
1998	3	597,587	6,419,033	192,571	0	192,571
1999	4	0	6,419,033	192,571	0	192,571
2000	5	0	6,419,033	192,571	0	192,571
2001	6	0	6,419,033	192,571	0	192,571
2002	7	0	6,419,033	192,571	0	192,571
2003	8	0	6,419,033	192,571	0	192,571
2004	9	0	6,419,033	192,571	0	192,571
2005	10	0	6,419,033	192,571	0	192,571
2006	11	0	6,098,081	182,942	320,952	503,894
2007	12	0	5,777,130	173,314	320,952	494,266
2008	13	0	5,456,178	163,685	320,952	484,637
2009	14	0	5,135,226	154,057	320,952	475,008
2010	15	0	4,814,275	144,428	320,952	465,380
2011	16	0	4,493,323	134,800	320,952	455,751
2012	17	0	4,172,371	125,171	320,952	446,123
2013	18	0	3,851,420	115,543	320,952	436,494
2014	19	0	3,530,468	105,914	320,952	426,866
2015	20	0	3,209,517	96,285	320,952	417,237
2016	21	0	2,888,565	86,657	320,952	407,609
2017	22	0	2,567,613	77,028	320,952	397,980
2018	23	0	2,246,662	67,400	320,952	388,351
2019	24	0	1,925,710	57,771	320,952	378,723
2020	25	0	1,604,758	48,143	320,952	369,094
2021	26	0	1,283,807	38,514	320,952	359,466
2022	27	0	962,855	28,886	320,952	349,837
2023	28	0	641,903	19,257	320,952	340,209
2024	29	0	320,952	9,629	320,952	330,580
2025	30	0	0	0	320,952	320,952

Notes : 1) 3.0 percent interest rate per annum

2) Grace period of 10 years, counted from the first disbursement

Table 12.2.6 Project Loan Disbursements and Repayments (Case C)

(Unit : US$)

Calendar Year	Project Year	Foreign Loan	Accumulated Foreign Loan	1) Interest Payment	2) Capital Payment	Total Payment
1996	1	3,551,822	3,551,822	26,639	0	26,639
1997	2	2,269,624	5,821,446	43,661	0	43,661
1998	3	597,587	6,419,033	48,143	0	48,143
1999	4	0	6,419,033	48,143	0	48,143
2000	5	0	6,419,033	48,143	0	48,143
2001	6	0	6,419,033	48,143	0	48,143
2002	7	0	6,419,033	48,143	0	48,143
2003	8	0	6,419,033	48,143	0	48,143
2004	9	0	6,419,033	48,143	0	48,143
2005	10	0	6,419,033	48,143	0	48,143
2006	11	0	6,205,065	46,538	213,968	260,506
2007	12	0	5,991,097	44,933	213,968	258,901
2008	13	0	5,777,130	43,328	213,968	257,296
2009	14	0	5,563,162	41,724	213,968	255,691
2010	15	0	5,349,194	40,119	213,968	254,087
2011	16	0	5,135,226	38,514	213,968	252,482
2012	17	0	4,921,259	36,909	213,968	250,877
2013	18	0	4,707,291	35,305	213,968	249,272
2014	19	0	4,493,323	33,700	213,968	247,668
2015	20	0	4,279,355	32,095	213,968	246,063
2016	21	0	4,065,388	30,490	213,968	244,458
2017	22	0	3,851,420	28,886	213,968	242,853
2018	23	0	3,637,452	27,281	213,968	241,249
2019	24	0	3,423,484	25,676	213,968	239,644
2020	25	0	3,209,517	24,071	213,968	238,039
2021	26	0	2,995,549	22,467	213,968	236,434
2022	27	0	2,781,581	20,862	213,968	234,830
2023	28	0	2,567,613	19,257	213,968	233,225
2024	29	0	2,353,645	17,652	213,968	231,620
2025	30	0	2,139,678	16,048	213,968	230,015
2026	31	0	1,925,710	14,443	213,968	228,411
2027	32	0	1,711,742	12,838	213,968	226,806
2028	33	0	1,497,774	11,233	213,968	225,201
2029	34	0	1,283,807	9,629	213,968	223,596
2030	35	0	1,069,839	8,024	213,968	221,992
2031	36	0	855,871	6,419	213,968	220,387
2032	37	0	641,903	4,814	213,968	218,782
2033	38	0	427,936	3,210	213,968	217,177
2034	39	0	213,968	1,605	213,968	215,573
2035	40	0	0	0	213,968	213,968

Notes : 1) 0.75 percent interest rate per annum

2) Grace period of 10 years, counted from the first disbursement

Figure 12.2.1 Hand Pump Type

Type pompes à main

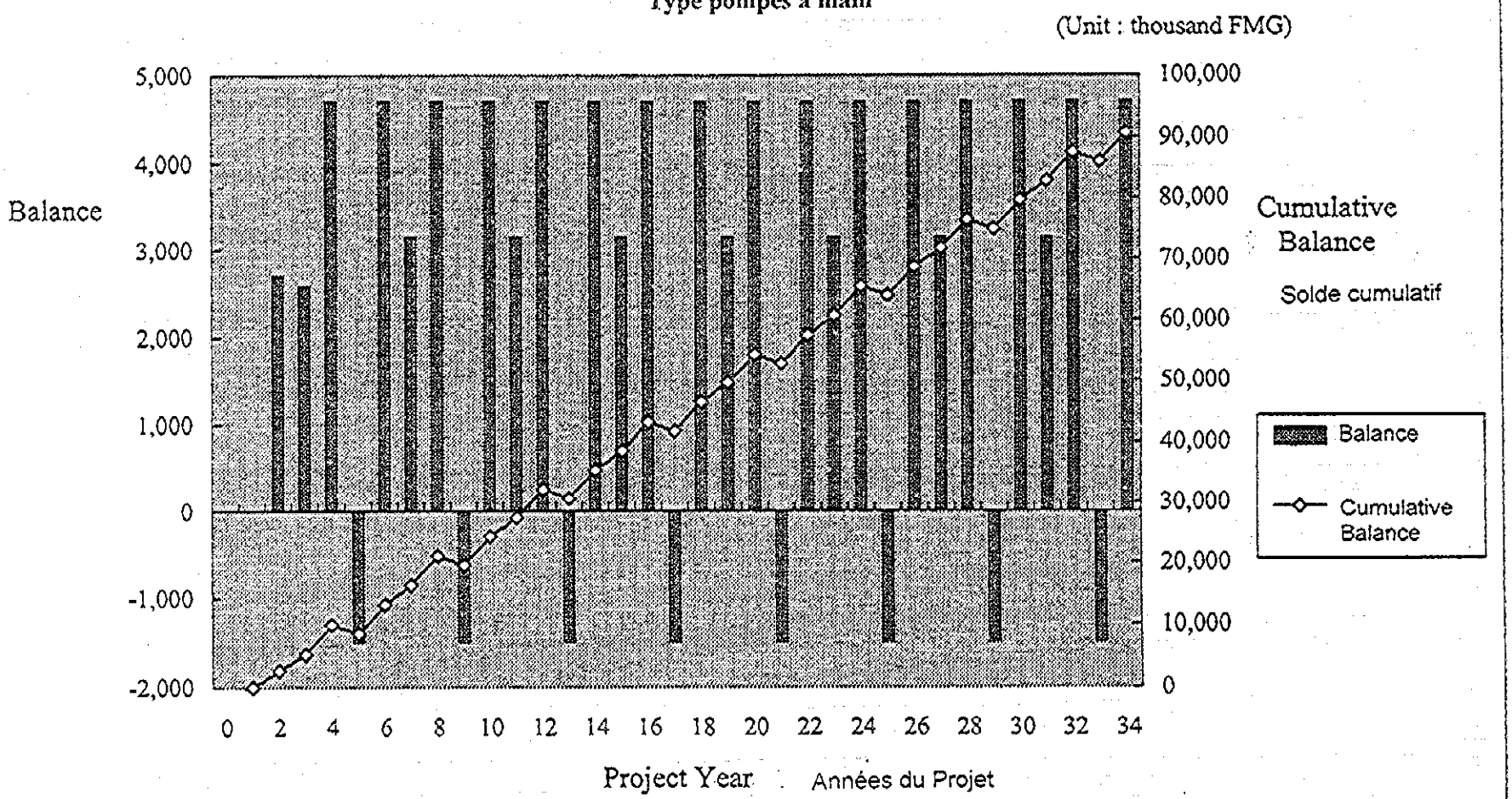


Figure 12.2.2 Générator Type

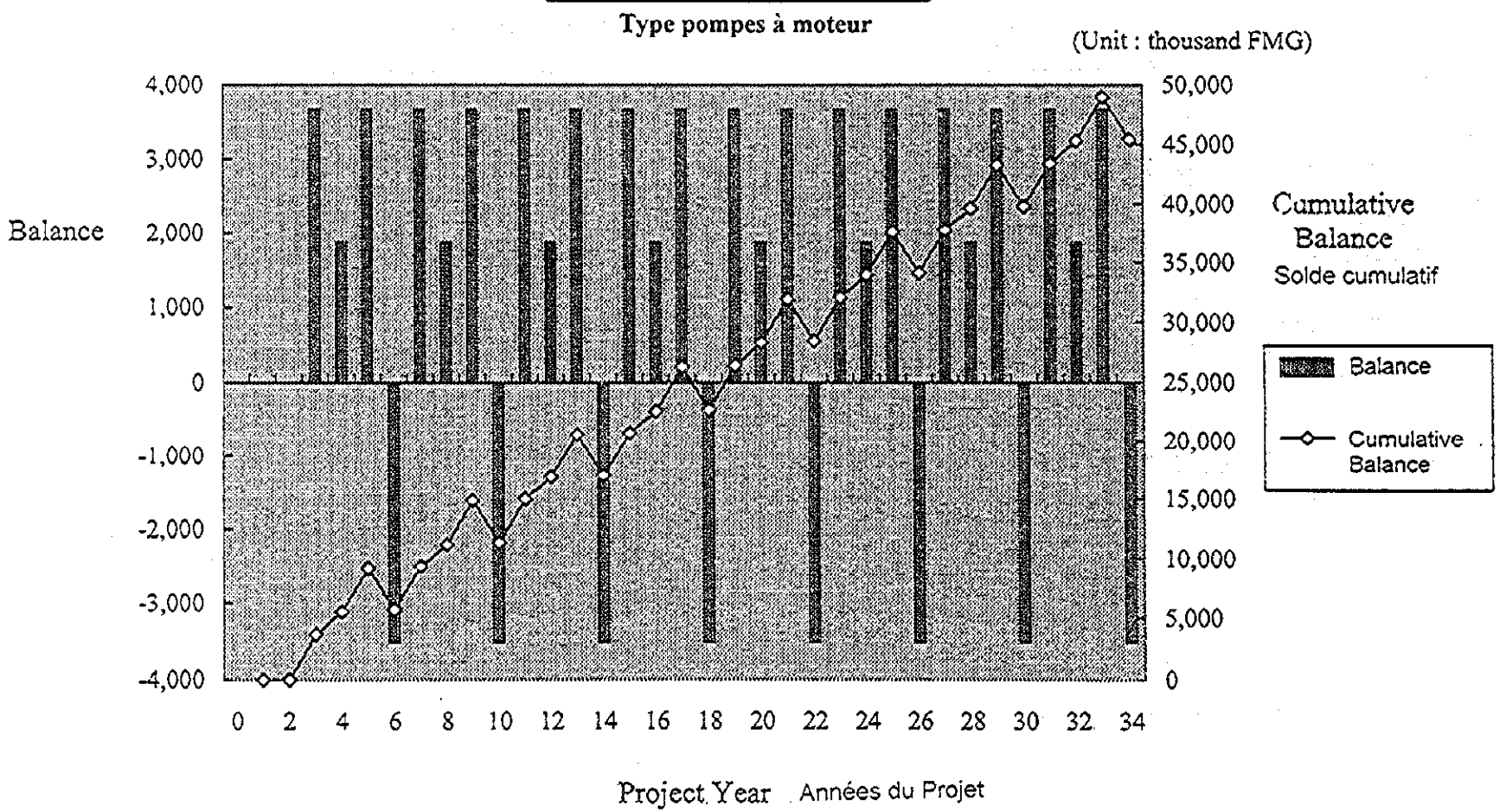


Figure 12.2.3 Solar Type

Type pompes à panneaux solaires

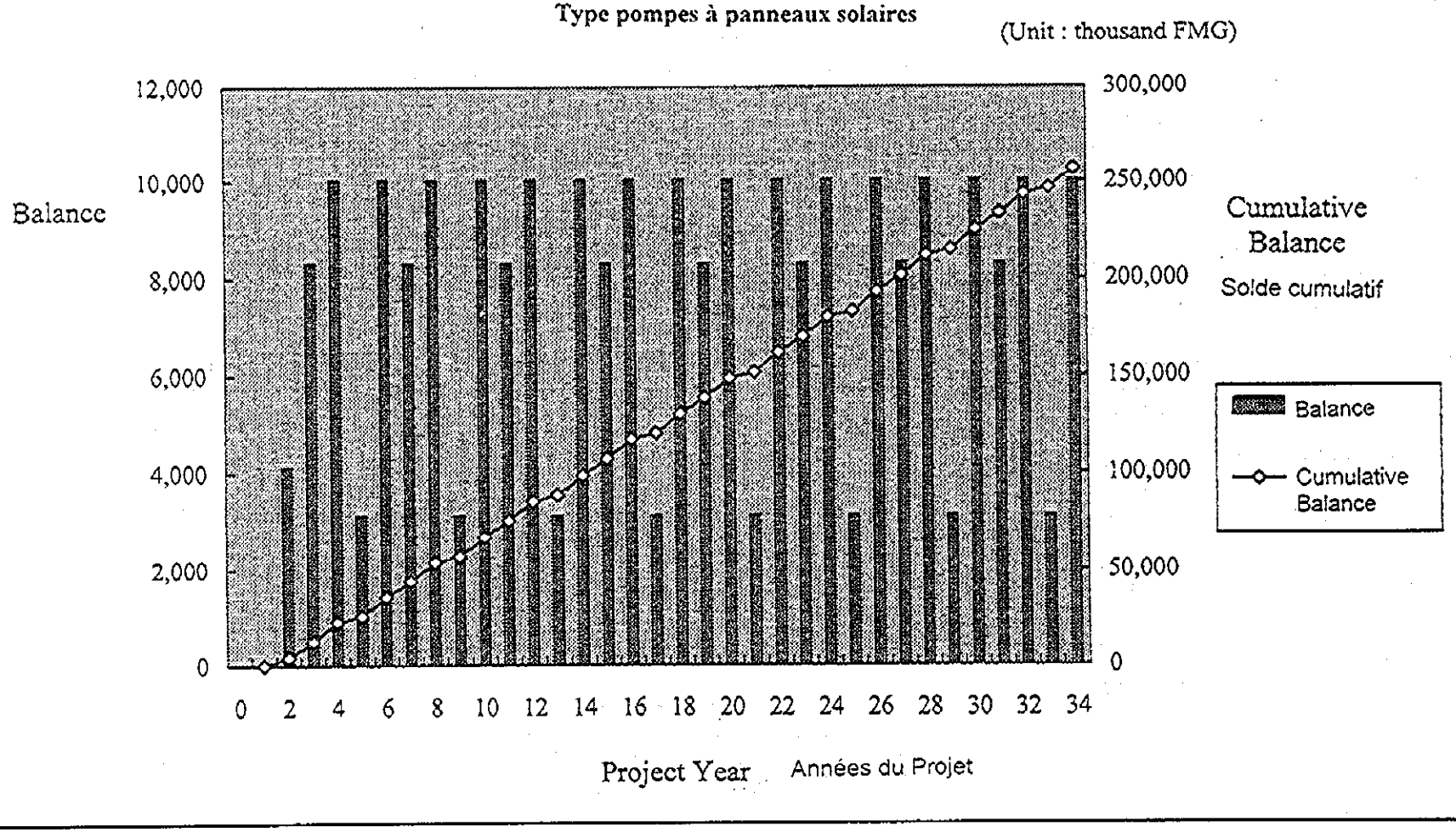


Figure 12.2.4 Accumulated Foreign Loan

Emprunts étrangers accumulés

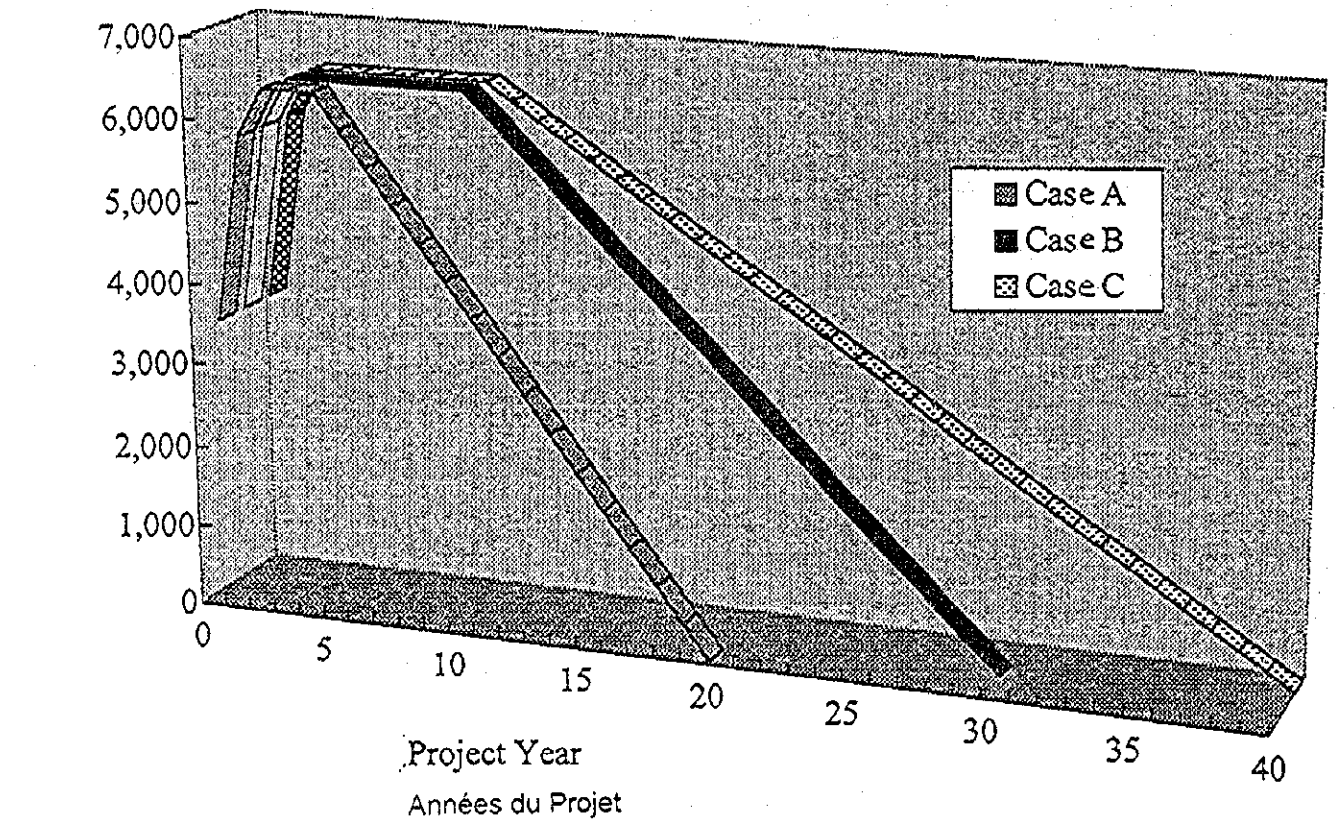
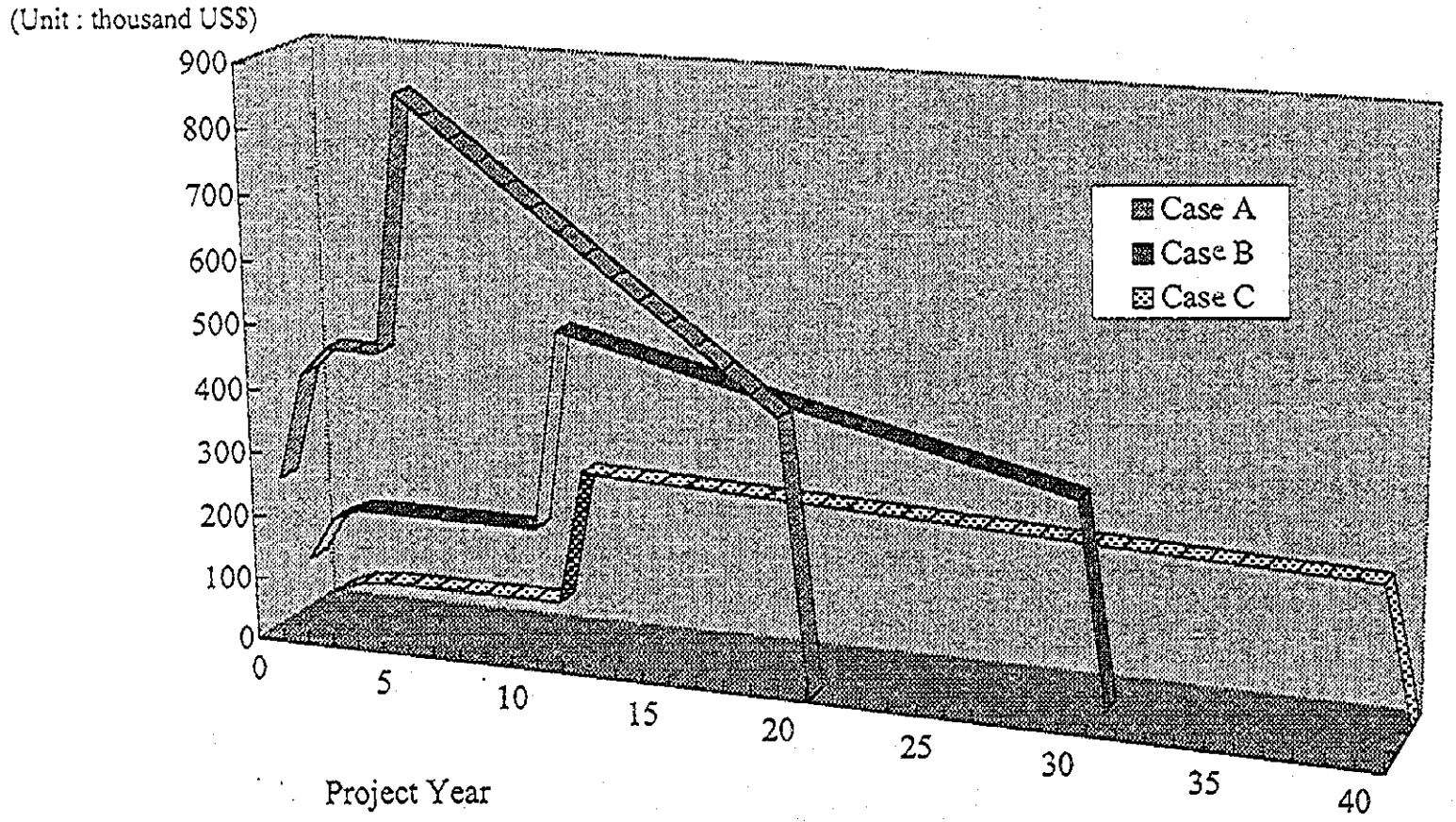


Figure 12.2.5 Total Payment

Totai des paiements



12.3 Social Evaluation

The economic and financial evaluation of the Project deal with the efficiency of the Project. EIRR gauges the economic profitability in the whole economy, and it is often the case that who will be benefit or the distribution of benefits among various social groups has often been neglected. Therefore, in this section, the social impact by the Project shall be carefully examined.

12.3.1 Social Impact on Gender

Gender issues are the first aspect in the social impact by the Project. Since women are the most important beneficiary group of the Project, the social impact on women will be one of the critical issues in the social evaluation of the Project. Fig. 12.3.1 illustrates the project impact on women's life style, showing that fetching water takes considerable time in their daily lives.

Since the implementation of the Project will make the beneficiary villages be conveniently located for fetching water, a great deal of women's time for fetching water will be saved. Table 12.3.1 more precisely estimated the women's time saving of fetching water by the Project;

1) that the total present annual time for fetching water in all the 80 accessible villages is approximately 12,251 thousand hours:

2) that the total reduced annual time for fetching water after the implementation of the Project is approximately 3,356 thousand hours: and

3) that the total annual saving time for fetching water is approximately 8,895 thousand hours.

However, the important point here is that the benefits to be obtained from the saved time depend on the availability of work alternatives to productively using the saved time.

12.3.2 Social Impact on Equity

Equity issue is the second aspect in the social impact by the Project. The regional distribution of the project benefits in the whole Madagascar is another important aspect of the social evaluation. Fig. 12.3.2 and Fig. 12.3.3 illustrate the onset rates of waterborne diseases by region in Madagascar, indicating that Toliara former Faritany is the worst region among all the former Faritany in that the on-set rate of waterborne diseases is 9.3%, and adding that the rate in Departemanta Beroroha is the worst in Toliara former Faritany at 11.4%. Therefore, the project, which shall benefit the region

where the health conditions are the worse off than any other region in Madagascar will be socially justifiable.

12.3.3 Other Social Impacts

The project will accrue other unquantifiable social benefits than the above social benefits.

(1) Creation of Community Development

In addition to the primary role of water associations, water associations will act as coordinators of various activities for health and sanitation in the rural communities. Through the activities of the water associations, the communities will be aware of the importance of 1) efficient-minded management capacity and 2) problem-solving capacity to improve their communities.

(2) Enhancement of Health and Sanitary Conditions

The Project will enhance people's awareness of the importance of health and sanitation through the supply of potable water. As discussed in 12.1.4, the Project will significantly mitigate the mortality rate due to waterborne diseases. It is estimated that the reduction in the mortality rate at birth by the implementation of the Project is 4.53 per 1,000 persons for men and 3.91 per 1,000 persons for women, and it is also estimated that the annual total project benefit is US$ 270,462 in monetary terms. These benefits will enhance the people's awareness of the importance of health and sanitation through the supply of potable water.

(3) Strengthening of Relation between the Governmental Officials and People

Since the operation and maintenance in the groundwater development project will require close contact with the government officials, the implementation of the Project will strengthen the unity between these two parties.

Table 12.3.1 Impact on Women's Time Saving for Fetching Water by Project (1/3)

No.	Village	Number of Households	Average Distance to Water Sources (m)	Average Daily Frequency of Fetching Water per Household (Times)	Average Time of Fetching Water per Household (Minutes)	Average Daily Time of Fetching Water per Household (Minutes)	Total Annual Time for Fetching Water (Hour)	Total Reduced Annual Time for Fetching Water (Hour)	Total Annual Saving Time for Fetching Water (Hour)
1	Andranopasy I	623	50	3	7	21	79,588	37,899	41,689
2	Andranopasy II	226	700	2	33	66	90,739	13,748	76,991
3	Antaly	327	1200	1	53	53	105,430	19,893	85,538
4	Darika	327	300	3	17	51	101,452	19,893	81,559
5	Befamonty	450	900	3	41	123	336,713	27,375	309,338
6	Anbatobe	220	1500	1	65	65	86,992	13,383	73,608
7	Nositonga	260	200	3	13	39	61,685	15,817	45,868
8	Nosibe	600	600	2	29	58	211,700	36,500	175,200
9	Ankoba	410	600	2	29	58	144,662	24,942	119,720
10	Antseranandaka Nord	342	100	3	9	27	56,174	20,805	35,369
11	Tsaramandroso	237	1000	1	45	45	64,879	14,418	50,461
14	Tanambahiny	131	300	3	17	51	40,643	7,969	32,674
15	Miary	365	700	2	33	66	146,548	22,204	124,343
16	Ambivy I	130	600	2	29	58	45,868	7,908	37,960
17	Ambivy II	500	300	3	17	51	155,125	30,417	124,708
18	Ambahia	200	30	3	6	19	22,630	12,167	10,463
19	Besatrohaka	210	30	3	6	19	23,762	12,775	10,987
20	Marolafila Atsimo	500	50	3	7	21	63,875	30,417	33,458
23	Marerano	1,100	200	3	13	39	260,975	66,917	194,058
25	Befasy	2,000	30	3	6	19	226,300	121,667	104,633
26	Antevamena	360	400	3	21	63	137,970	21,900	116,070
27	Mitsitily	340	300	3	17	51	105,485	20,683	84,802
28	Andranovorisosotra	40	300	3	17	51	12,410	2,433	9,977
29	Ankitatamahavelo	190	500	2	25	50	57,792	11,558	46,233
30	Bekininy Soarano	400	30	3	6	19	45,260	24,333	20,927

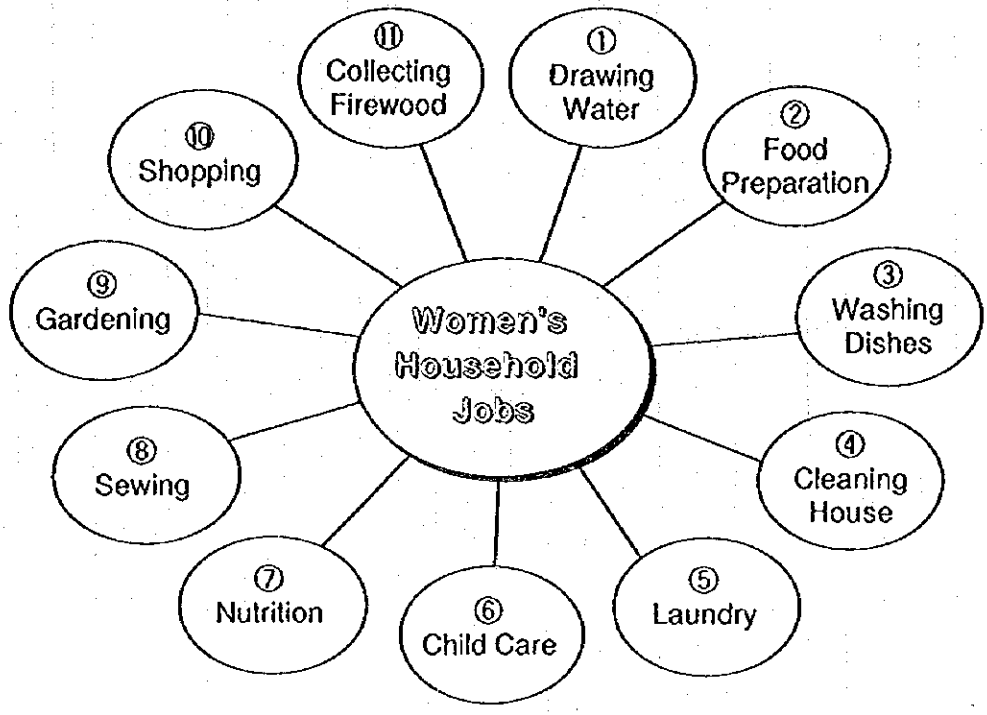
Table 12.3.1 Impact on Women's Time Saving for Fetching Water by Project (2/3)

31	Belco	800	50	3	7	21	102,200	48,667	53,533
32	Anadabo	36	400	3	21	63	13,797	2,190	11,607
33	Misokotsa	800	30	3	6	19	90,520	48,667	41,853
34	Croisement Besotroka	200	10000	1	405	405	492,750	12,167	480,583
35	Amanga	400	300	3	17	51	124,100	24,333	99,767
36	Namakia	400	300	3	17	51	124,100	24,333	99,767
39	Antsamaka	150	1000	1	45	45	41,063	9,125	31,938
40	Manomentinay	436	300	3	17	51	135,269	26,523	108,746
41	Farateny	250	30	3	6	19	28,288	15,208	13,079
43	Andrananja	70	400	3	21	63	26,828	4,258	22,569
46	Marofihitsa	750	30	3	6	19	84,863	45,625	39,238
47	Ambararata	500	100	3	9	27	82,125	30,417	51,708
48	Ankevo	300	30	3	6	19	33,945	18,250	15,695
50	Bevantaza	150	30	3	6	19	16,973	9,125	7,848
52	Antsakamirohaka	1,600	30	3	6	19	181,040	97,333	83,707
53	Androvakely	550	30	3	6	19	62,233	33,458	28,774
55	Ampananiha	420	150	3	11	33	84,315	25,550	58,765
56	Antseranambondro	60	800	2	37	74	27,010	3,650	23,360
58	Bemanonga	1,250	500	2	25	50	380,208	76,042	304,167
59	Marovoay	1,247	30	3	6	19	141,098	75,859	65,239
60	Tandrokosy	238	150	3	11	33	47,779	14,478	33,300
61	Bekonazy	40	30	3	6	19	4,526	2,433	2,093
64	Andranomena Atsimo	210	200	3	13	39	49,823	12,775	37,048
65	Tanandava	250	100	3	9	27	41,063	15,208	25,854
66	Croisement (BST)	204	300	3	17	51	63,291	12,410	50,881
67	Analaiva	1,520	30	3	6	19	171,988	92,467	79,521
68	Betsipotika	120	30	3	6	19	13,578	7,300	6,278
69	Amboloando	150	400	3	21	63	57,488	9,125	48,363

Table 12.3.1 Impact on Women's Time Saving for Fetching Water by Project (3/3)

70	Ampandra	600	30	3	6	19	67,890	36,500	31,390
72	Antevamena II	100	30	3	6	19	11,315	6,083	5,232
74	Tsinjorano	450	30	3	6	19	50,918	27,375	23,543
76-I	Laijoby Avaratra	150	500	2	25	50	45,625	9,125	36,500
79	Ambonio	270	30	3	6	19	30,551	16,425	14,126
80	Analalava	300	30	3	6	19	33,945	18,250	15,695
81	Malandirano	400	100	3	9	27	65,700	24,333	41,367
82	Marofandiliha	370	30	3	6	19	41,866	22,508	19,357
83	Ampataka	695	200	3	13	39	164,889	42,279	122,610
89	Ankaraobato	800	30	3	6	19	90,520	48,667	41,853
93	Boraboka Atsimo	783	200	3	13	39	185,767	47,633	138,134
94	Ankilivalo	2,960	30	3	6	19	334,924	180,067	154,857
95	Ambohibary	300	300	3	17	51	93,075	18,250	74,825
97	Bezezika	855	500	2	25	50	260,063	52,013	208,050
99	Ankilimida	600	300	3	17	51	186,150	36,500	149,650
100	Ampanihy	742	300	3	17	51	230,206	45,138	185,067
101	Benato	500	800	2	37	74	225,083	30,417	194,667
102	Anolotsy	300	200	3	13	39	71,175	18,250	52,925
103	Ankilizato	4,200	50	3	7	21	536,550	255,500	281,050
104	Mandabe	2,000	100	3	9	27	328,500	121,667	206,833
106	Malaimbandy	7,000	1000	1	45	45	1,916,250	425,833	1,490,417
107	Ampanotoka	900	300	3	17	51	279,225	54,750	224,475
109	Tsianaloka	1,000	400	3	21	63	383,250	60,833	322,417
110	Kiboy	930	350	3	19	57	322,478	56,575	265,903
112	Tsimafana	1,500	100	3	9	27	246,375	91,250	155,125
113	Mananjaky	1,170	30	3	6	19	132,386	71,175	61,211
114	Ambatolahy	800	800	2	37	74	360,133	48,667	311,467
115	Ankotrofotsy	908	100	3	9	27	149,139	55,237	93,902
Total / Average		55,172	414.4	2.7	21.6	44.0	12,250,855.1	3,356,296.7	8,894,558.5

Figure 12.3.1 Project Impact on Women's Life Style



No.	Kind of Job	hours	%
①	Drawing Water	1.0	7.1%
②	Food Preparation	1.0	7.1%
③	Washing Dishes	0.5	3.6%
④	Cleaning House	1.0	7.1%
⑤	Laundry	1.0	7.1%
⑥	Child Care	3.0	21.4%
⑦	Nutrition	3.0	21.4%
⑧	Sewing	0.5	3.6%
⑨	Gardening	1.0	7.1%
⑩	Shopping	1.0	7.1%
⑪	Collecting Firewood	1.0	7.1%
Total		14.0	100%

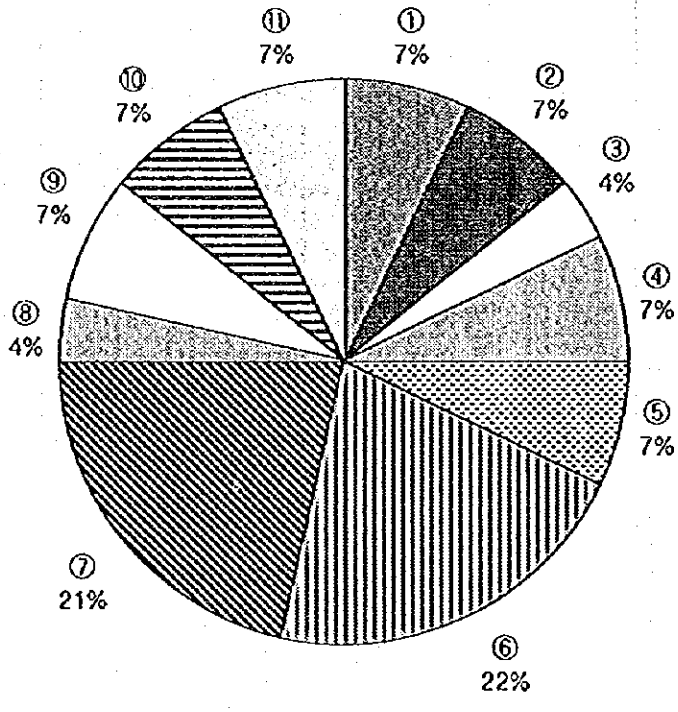
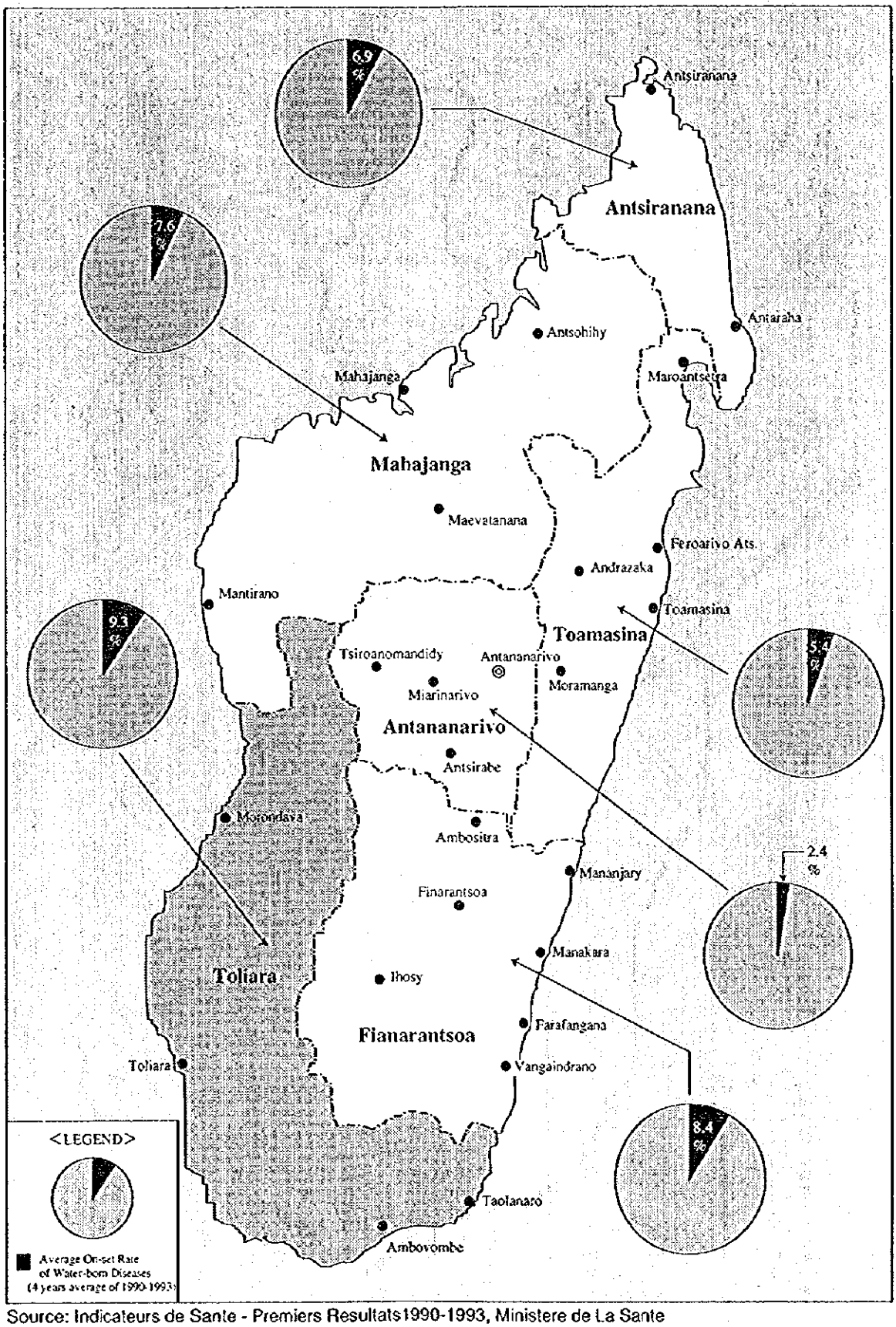
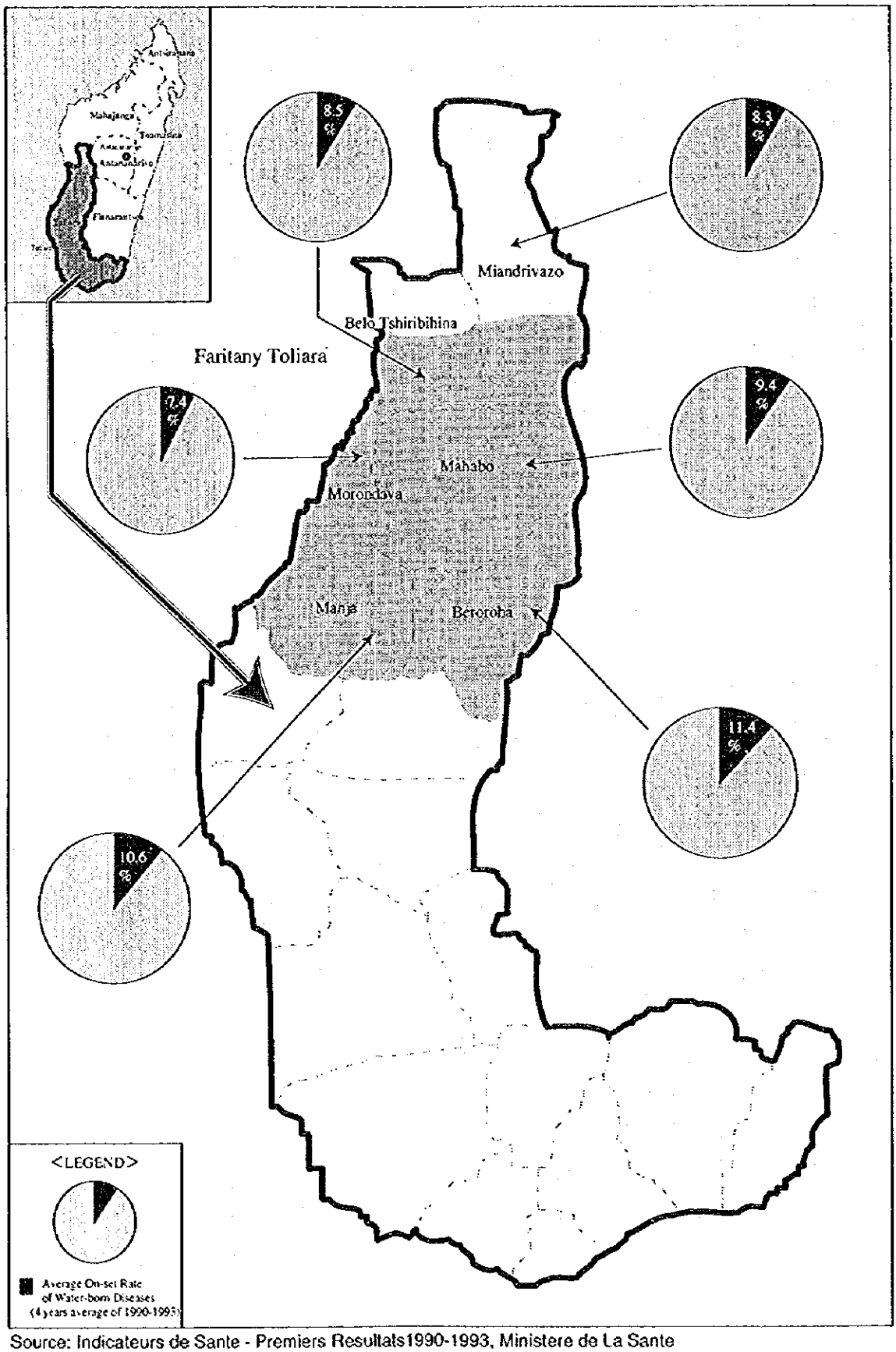


Figure 12-3-2 On-set Rates of Water-born Diseases by Faritany



Source: Indicateurs de Sante - Premiers Resultats1990-1993, Ministere de La Sante

Figure 12-3-3 On-set Rates of Water-diseases in Project Area



Source: Indicateurs de Sante - Premiers Resultats1990-1993, Ministere de La Sante

12. 4 Overall Project Evaluation

The Project is designed to supply potable water for the villagers in the South-Western region of Madagascar, thereby meeting the basic human needs in the rural areas where water shortage is so alarming as it significantly increases the incidence of waterborne diseases. The Project was economically evaluated in terms of cost-benefit analysis, financially evaluated in terms of cost recovery and foreign loan disbursement, and socially evaluated in terms of social impacts on gender and equity.

Economically, the Project was assessed in the context of the national economy. The basic methodology employed in the economic evaluation is the cost-benefit analysis which employs EIRR as a criterion to judge the economic viability. The reduction in waterborne diseases was quantified in the form of monetary value by means of Disease Impact Analysis (DIA) method which converted the reduction in waterborne diseases into the saved life expectancy. Two cases of Case A (all the 80 candidate villages) and Case B (highly prioritized 60 villages) were set up for the economic evaluation.

The result of the economic evaluation shows that although all the EIRR for Case A recorded 1.27% and the EIRR for Case B recorded 1.48%, both are very low. The result implies that the economic viability of the Project is not so high compared with projects of other sectors, adding that grant aid or soft loans with an extremely high grant element shall be required for the implementation of the Project.

Financially, the Project was assessed in terms of the financial viability of the Project from the viewpoint of project entities. The financial viability of the Project was evaluated in terms of two project entities: water associations and the Madagascar government. The former financial soundness was judged by the cost recovery analysis of water associations, and the latter was gauged by the foreign loan disbursement analysis of the government of Madagascar.

Regarding the cost recovery of water associations, in any type of facilities, the water fee collected by the associations will successfully cover the operation and maintenance cost, generating accumulated cash balance sufficient to cover even a small part of the capital cost.

Regarding the foreign loan disbursement of the government of Madagascar, even in the case where the concessionality level is low with a high grant element, the maximum payment of both interest payment and amortization occupy a small part of the recurrent budget of the Madagascar government.

In summary, it could be safely argued that both the cost recovery of the water

associations and the foreign loan disbursement of the government of Madagascar verify the financial soundness of the Project.

Socially, the Project was assessed in terms of the distribution of benefits among various social groups. It is often the case that who will be benefited or the distribution of benefits among various social groups has been neglected. Therefore, the Project was evaluated from the viewpoints of gender and equity, two major groupings of the society.

In connection with the social impact on women, as the implementation of the Project will make the beneficiary villages be conveniently located for fetching water, a great deal of women's time for fetching water will be saved.

In connection with the social impact on equity, the Project, which shall benefit the region where the mortality rate from waterborne diseases are worse off than any other region, will mitigate inequitable distribution of health resources among regions, thereby giving favourable social impacts on the regional socio-economic situation.

In addition to the favourable social impacts on gender and equity, the Project will accrue other unquantifiable social impacts such as the creation of community development, enhancement of health and sanitary conditions, and strengthening of the relation between the governmental officials and the people.

In conclusion, although the economic viability of the Project is not so high compared with the opportunity cost of capital in Madagascar, it is suggested that the Project be urgently implemented by mobilizing the financial sources such as a grant aid or a soft loan with the relatively high grant element, taking into consideration the fact that:

1) the Project is financially sound in terms of both the cost recovery of the water associations and the foreign loan disbursement of the government of Madagascar, and

2) the Project will have favourable social impacts on gender and equity together with other social benefits.

13. CONCLUSIONS AND RECOMMENDATIONS

13.1 Conclusions

Listed below are the major conclusions from the results of the Study.

(1) Evaluation for the Phase I Project

The daily operation of the water supply facilities appeared to be generally good, except for a few villages in the Phase I Project area. This was evident by the comparatively high collection rate of operation fees and the supply of good quality water to the beneficiaries under the management of the water associations formed in each of the concerned villages.

However, none of the motorized supply systems were operating properly so far as the supply amount is concerned. The average daily supply amount per person ranges from only 2 to 10 liters a day, regardless of the fact that the facilities are capable of providing each person with the recommended 20 liters a day.

This is explained by economization of operational expenses; this frame of mind has probably originated from the following two factors :

- The villagers have long been accustomed to use water free of charge, so therefore a sense of willingness to pay for the water supply services has not been established in this area.
- Not enough effort has been put into the campaign and education on the use of safe domestic water by the authorities concerned. In particular, periodical patrols by the most responsible body, the MEM Regional Office, has been outstandingly poor.

(2) Socio-Economic Conditions

Shortages of safe water for domestic use are severe in most of the candidate villages, resulting in high incidence of waterborne diseases and also in the prevention of the social and economic development activities.

The populations of the candidate villages is much smaller than those in the Phase I area. Of 81 villages surveyed, the number of the villages with a population (1995) over 1,000 was 13, and the average population of the remaining 68 villages was 390. A comparison of the 50 villages by population with the Phase I area villages (1990, before project implementation) is given below:

Population scale	Number of Villages	
	Phase II Area (1995)	Phase I Area (1990)
Over 3000	2	6
1000～2999	11	26
500～999	21	15
under 500	16	3

Since the main economic activities are limited to self-sufficient small-scale agriculture and stock farming in most of the candidate villages in the Phase II Study Area, the average household income is lower than in the Phase I area, and consequently, the affordability to pay for the water supply services is lower than that in the Phase I area.

(3) Groundwater Development Potential of the Study Area

The Groundwater Development Potential in this Study Area is generally high. The area is composed of 11 sub-areas : 3 coastal plains and 8 river basins, of which the daily groundwater development potential per square kilometer for 8 sub-areas is given below. Even in the smallest potential sub-area (Maharivo river basin) is of sufficient level for groundwater use of domestic water supply.

Sub-areas	Area (km^2)	Development Potential of the Area (m^3/day)	Daily D/P per 1 km^2 (m^3/day km^2)
Morondava Plain	6,006	5,689,932	947
Andranomena River Basin	882	499,151	566
Morondava River Basin (1)	677	170,983	253
(2)	3,885	850,229	219
Sakeny River Basin	2,183	443,808	203
Maharivo River Basin (1)	602	106,085	176
(2)	2,299	411,565	179
Kirindy River Basin	1,050	301,927	288
Maintapaka River Basin (1)	397	123,884	312
(2)	364	102,487	282
Mangoky River Basin (1)	1,301	490,816	377
(2)	3,173	1,347,004	424

For the other 3 sub-areas: Tsiribihina River basin, Tsiribihina delta and Mangoky delta, the development potential per unit area (1 km^2) has not been estimated by means of a macroscopic water balance analysis. It is assumed, however, that these sub-areas also have a high potential. The deltas are underlain by a vast thick clay bed overlying sandy layers of a confined aquifer.

(4) Existence of poor quality groundwater

In many places within the delta and coastal plains, aquifers of saline water are interbedded with fresh water aquifers. In such places the wells should be carefully constructed with the well screens properly positioned at the fresh water aquifer. It is estimated that approximately half of the boreholes will encounter saline water aquifers, of which around 50% may be dealt with by sealing of saline portion, while the others will require additional drilling, resulting that approximate 25% extra drilling within the deltas and coastal plains should be considered at the time of the well construction planning.

At the places where dykes are present, the groundwater may not be potable due to the high content of dissolved matter related with hot springs. The drilling point, especially for deep well construction, should be kept away from dykes or related fault lines.

(5) Groundwater development plan and water supply facilities plan

For all of the 81 surveyed villages, a groundwater development plan was established to supply 20 liters daily to each of the projected population in 2005, by construction of the appropriate number of borehole wells in the concerned villages.

Three types of water supply facilities have been planned in accordance with the socio-economic categorization of the candidate villages, especially in due consideration of easy and low cost operation and maintenance :

a. Borehole wells equipped with a hand pump, one well supplying 210 persons, therefore, the necessary number of wells per village is the quotient of the projected village population divided by 210.
[For the 55 villages where the population is about 800 or smaller.]

b. Single borehole well equipped with submersible motor pump, and the distribution system composed of a distribution tank, distribution pipeline and communal faucets. One faucet is to supply no more than 400 people, therefore, the necessary number of faucets is the quotient of population divided by 400. The energy for the motor pumps is to come from photovoltaic solar panels. The number of panel varies depending on pump head and the volume of water to be pumped up.

[For the 17 villages with populations over 800 and not exceeding 2000.]

c. Same source and similar distribution system as b.), but, the electrical power is derived from a diesel engine generator.
[This type of system is for the 8 villages located along or close to national routes 34 and 35, where access to fuel supply is possible even in the rainy season.]

(6) Operation and Maintenance

Basically, operation and maintenance of the water supply facilities should be undertaken autonomously by the project beneficiaries, that is, by water associations in the concerned villages.

However, since it is natural that there is a limitation in both financial and technical aspects for autonomous management in the rural areas, a large amount of assistance and guidance from the concerned authorities is necessary, especially from the project implementing body and the local authorities.

The demarcation of responsibility for operation and maintenance is as follows:

- Water associations are responsible for the daily operation of the facilities and repairing minor troubles with their own funds, the regularly collected O/M fee.
- MEM, as the implementing body of the project, is responsible for the management and control of the overall O/M program by conducting periodical patrols. The establishment of a branch office in Morondava is essential in order to fulfill this responsibility. MEM is also responsible for the heavy repair works, replacement of pumping and power generating equipment, and rehabilitation or re-drilling of the borehole wells with their own funds and manpower, or seeking the technical assistance from JIRAMA.
- Decentralized administrative units, especially Departemantas, are responsible for providing assistance with communication between the villages and MEM. Local committees like the Morondava Development Committee are responsible for giving technical and institutional guidance to the concerned villages.

(7) Project Cost

Covering the 81 surveyed villages, the facility construction cost, including the management office setting up cost, administrative and engineering costs and contingencies, totals approximately US$ 9.43 million.

For the 60 prioritized villages, which are categorized as AA, AB, BA and BB, the construction cost of those items listed above totals approximately US$ 8.5 million. (Foreign portion : USS 5.82 million, Local portion : FMG 10,908 million)

The annual operation and maintenance cost covering the 60 prioritized villages comprise the following 3 factors, totaling approximately US$ 72,435.

a) Average annual running cost of the project management office (assumed Morondava branch office of MEM) : US$ 10,696

b) Average annual maintenance cost for the wells : US$ 1,523

c) Annual operation and maintenance cost, excluding the maintenance of the wells, totals US$ 60,216 with the following breakdown :

Unit: US$

	Range		Total	Average
	Min.	Max.		
Hand pump well for 35 villages	260	587	14,868	425
Solar powered supply system for 17 villages	541	646	9,312	547
Diesel engine powered supply system for 8 villages	2,262	12,893	36,036	4,504
Total			77,352	

(8) Project evaluation

The Project was economically assessed in the context of national economy. The reduction in waterborne diseases was quantified in the form of monetary value by means of the Disease Impact Analysis (DIA) method which converted the reduction in waterborne diseases into the saved life expectancy.

The result of the economic evaluation shows that although all the EIRR recorded 1.48%, implying that the economic viability of the Project is not so high compared with projects of other sectors, adding that a grant aid or soft loans with an extremely high grant element shall be required for the implementation of the Project.

The Project was financially assessed from the viewpoint of project entities. The financial viability of the Project was evaluated in terms of two project entities: water associations and the government of Madagascar judged by the foreign loan disbursement analysis.

For the recovery of water associations, in any type of facilities, the water fee collected by the associations will successfully cover the operation and maintenance cost, generating accumulated cash balance sufficient to cover even a small part of the capital cost. And, for the foreign loan disbursement of the government of Madagascar, even in the case where the concessionality level is low with the low grant element, the