

VOL. I CHAPTER 1
INTRODUCTION

CHAPTER I INTRODUCTION

1.1 Background of the Study

The piedmont and plain to the north the Haut Atlas mountain range running through the south of Morocco is the location of the numerous scattered villages which comprise the Study area. In this and other rural areas of Morocco reside nearly half (12.7 million as of 1995) of the nation's population. Rural villages total some 40,000 countrywide, accounting for around 2 million households (average of 50 households per village).

Electrification of these rural villages is being mainly carried out through extension of the existing grid by ONE, however, there are conditions in rural areas of poor access and other geographical constraints, as well as poor cost performance in terms of initial investment and resultant power consumption which make this approach disadvantageous in some cases. As a result, electrification rate for rural area in Morocco in 1994 remained at a low 21% compared with other countries in the general region, i.e. Egypt (84%), Algeria (80%), Tunisia (70%).

In light of this situation, the Moroccan government has designated rural electrification as a priority policy issue, and has embarked on a series of basic electrification programs. Specifically, this commenced with the phase I Rural Electrification National Program (PNER-I), followed by phase II of the same program (PNER-II) in the 1990s. In 1993, the Decentralized Energy National Program (PNED) was launched in 1993, aiming at the adoption of renewable energy sources to electrify rural areas which are not candidates for early connection to the national grid. Subsequently in 1995, the government embarked on the Pilot Rural Electrification Program (PPER) under cooperation from France.

In August 1995, the government announced the Global Regional Electrification Plan (PERG) which integrates the efforts under PNER and PNED. In June 1997, ERD (decentralized rural electrification) was inaugurated as a special project within the PERG framework, and subsequently in October 1997 details of funding format and management methodology of PERG were revised. Under the PERG program, 100,000 households are to be electrified per year over the 15 year period from 1996 to 2010, with all rural area in the country to be ultimately energized by the target year 2010. Required funding under the program is DH 1 billion per year.

On the other hand, the Center for Renewable Energy Development (CDER) was established in 1982 in Marrakech with the aim of promoting electrification of areas for which extension of the grid is not practical through the adoption of decentralized, renewable energy sources. In this light, CDER assumes a leadership role both technically and financially in decentralized electrification efforts based on study and research on renewable energy sources.

Against the above background, the Moroccan government (CDER as counterpart agency) in August 1995 requested technical cooperation from Japan in the formulation

of a master plan to electrify 120 villages in Haouz Region. The master plan will comprise an important component of the government's rural electrification strategy,

Haouz region is located on the northern slope of the Atlas range in the southwest of Morocco. Geographically, the region is separated by considerable distance from the northern coastal zone, and exhibits distinct features of economic backwardness in comparison with the more affluent northern area. Numerous villages are spread out over a wide area, with dwellings often situated in narrow valleys with poor access. As a result, the present electrification rate for Haouz region is only 14% which is significantly below the national average of 21%. Furthermore, per capita GNP for Haouz Region is estimated at US\$ 430 which is considerably below the national average of US\$ 1,040 (1993).

As indicated above, Haouz Region is lagging in relation to other regions of the country in terms of electrification, and moreover, is a high priority region for development given its status as an important hinterland area for Marrakech. Implementation of the electrification plan formulated under the Study is anticipated to increase the electrification rate of the Haouz Region from 14% to 23%, with a significant collateral impact on regional development.

1.2 Study Objective

The objective of the Study is to formulate a master plan for electrification of 120 villages in Haouz Province on the basis of an inventory study to be carried out for all alternatives to meet electricity demand of the area, including micro-hydropower, PV generation, etc., and to identify and carry out a pre-feasibility study for high priority micro-hydropower sites. Further to the above is the transfer of technology from the JICA Study Team to the Moroccan side counterparts such that the said counterparts will be capable of independently executing in the future surveys and planning similar to that under this Study. Technology transfer is to be achieved through study works performed jointly by the Team experts and their counterparts in the respective disciplines under the Study.

Implementation of the master plan for electrification, in addition to the primary objective of promoting electrification of Haouz region, can be expected to have the following impacts on regional development:

- Proliferation of visual sources of educational information, news, cultural development, etc.
- Extension of hours in the evening which can be utilized for study or work.
- Improved public service through electrification of schools, mosques and other public places, as well as the establishment of street lighting.
- Electrification will free residents from the laborious task of battery replacement, and enable this freed up time to be utilized in a more productive manner.

- Reduction of tree felling for fuel wood, and resultant brake on degradation of the natural environment.
- With improved living standards as a result of electrification, population migration to large urban centers will decrease.
- Electrification will contribute to a more robust tourist industry for the region.

1.3 Scope of the Study

The Study is to be carried out in accordance with the Scope of Work and Minutes of Meeting as signed on December 13, 1995 between the JICA Preparatory Study Team and Ministry of Energy and Mines (MEM) of the Kingdom of Morocco. The Study comprising the stages is briefly described below.

(1) Inventory Study Stage

With regard to the 120 villages targeted for electrification, existing data will be collected and analyzed. This will include the carrying out of a questionnaire survey to obtain relevant socio-economic data. Under method of electrification, all possible alternatives will be examined to include micro-hydropower, PV generation, diesel generation and extension of the existing grid.

Particular attention will be given the assessment of micro-hydropower and PV energy in light of the fact that these are renewable sources of energy. On the basis of the foregoing, the optimum method of electrification will be selected and a project inventory prepared.

With regard to candidate micro-hydropower sites, potential will be confirmed at the initial site reconnaissance, and hydrological survey will be carried out for the site areas. By the end of the Inventory Study stage, 3 of the most promising of the candidate sites will be selected for the Pre-feasibility Study.

(2) Pre-feasibility Study

Topographical survey, geological survey, meteo-hydrological survey, structural design, environmental survey and economic - financial analysis will be carried out for the 3 high priority sites. Recommendations will also be made on future project planning, and organizational set up for operation and maintenance.

1.4 Study Execution

The Master Plan Study was commenced in March 1996 and was completed in January 1998. During this term, the Study was carried out in accordance with the schedule described below. Work flow for main Study tasks is shown in Figure 1.4-1.

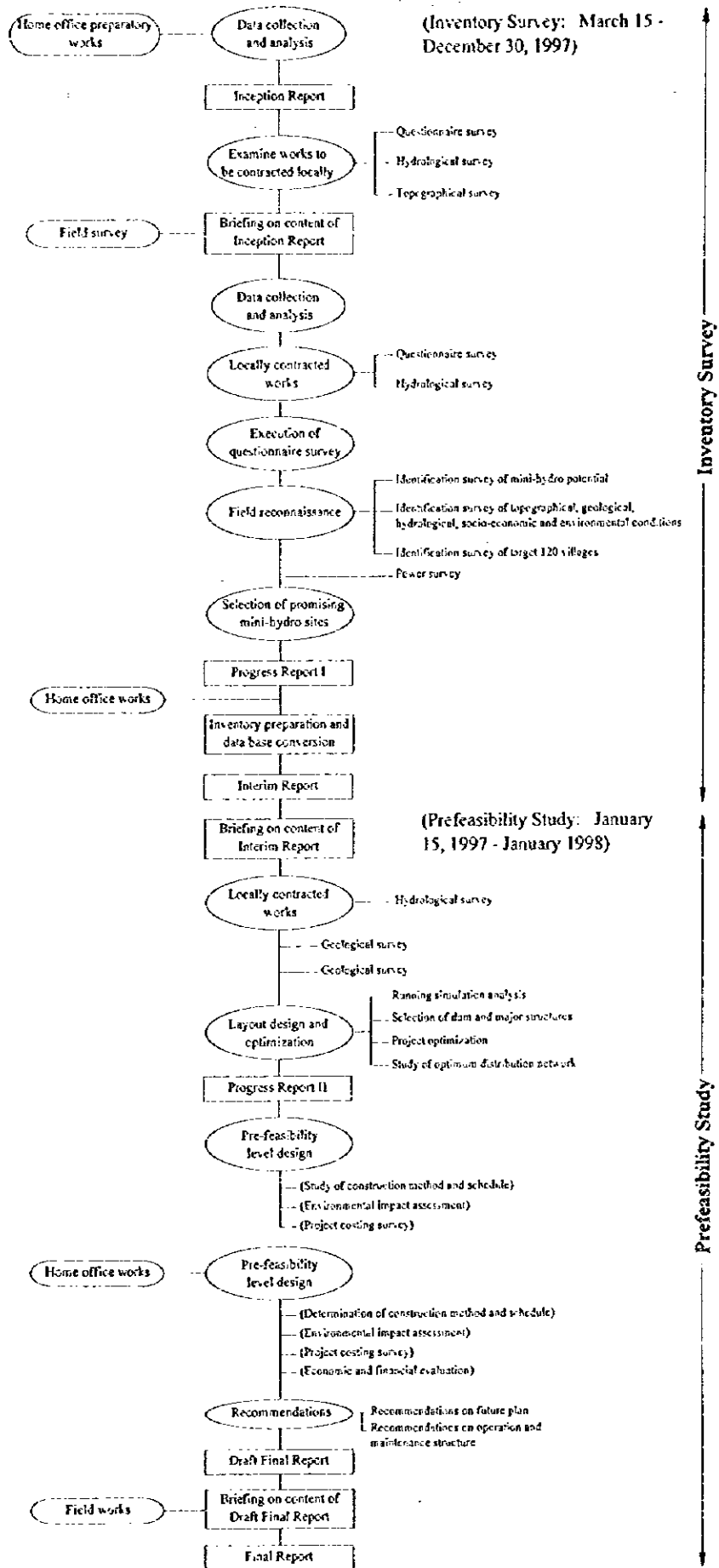
1) Inventory Study

- Home office preparatory works March 15~25, 1996
 Preparation of Inception Report
- Phase 1 field survey May 19 ~ October 15, 1996
 Presentation of Inception Report
 Preparation and presentation of Progress Report (1)
- Phase 1 home office works October 1 ~ December 30, 1996
 Preparation of Interim Report
- 2) Pre-feasibility Study
- Phase 2 field survey January 15 ~ March 21, 1997
 Presentation of Interim Report
 Preparation and presentation of Progress Report (2)
- Phase 3 field survey May 11 ~ June 9, 1997
- Phase 2 home office works June 10 ~ August 29, 1997
 Preparation of Draft Final Report
- Phase 4 field survey October 25 ~ November 8, 1997
 Presentation of Draft Final Report
 Preparation and presentation of Final Report (January 1998)

The JICA Study Team and CDER have cooperated closely in carrying out site reconnaissance and data collection. Strong cooperation has also been extended by Haouz Provincial Government and other local agencies and autonomies under its jurisdiction. Other related government agencies also cooperated closely with the Study Team in the collection of relevant data and information for the Study.

Questionnaire survey, installation of gauging stations, discharge measurement and topographical survey were carried out under sub-contract to a local consultant (Maghreb Projects A.C.). Water level observations were entrusted by CDER to the local residents of the Study area.

Figure 1.4-1 Study Works Flow Chart



1.5 Modification of Number of Target Villages

Under the original request by the Moroccan government, 120 villages were targeted under the master plan study. In the course of the Study, the following modifications in target villages were made on the basis of such criteria as redundancy with other on-going projects, etc. The process of this modification is illustrated in Table 1.5-1.

	<u>Target no. of villages</u>
Original request by Moroccan government:	120
Questionnaire survey:	114
Addition of Afra village:	115
After elimination of villages to be electrified by ONE:	106

Of the final above 106 villages, 101 are to be electrified by PV generation, diesel generation and micro-hydropower. The remaining 5 villages are subject to connection to the existing grid which is under the jurisdiction of ONE, and therefore implementation scheduling, as well as financial and economic evaluation for these has been eliminated from consideration in this Report.

Table 1.5-1 Summary of the Changes of the Douars for the Study

Changes of the douars (villages) for the study					Number of Douars	
					(-)	(+)
1) Number of nominated douars by CDER at initial stage					120	
2) Number of excluded douars due to existing electrification plan of ONE or GTZ, confirmed at preparatory meeting of reconnaissance survey on 03/June/96.					-10	0
<Excluded Douars>						
	No.	Douars	Commune Rurale	Cercle		
(1)	5	Tizgui (GTZ)	Imgdal	Asni		
(2)	14	Tamghist (GTZ)	Asni			
(3)	16	Ouanskra (GTZ)				
(4)	28	Tilouna (ONE)	Tahanaout	Tahanaout		
(5)	29	El Mars (ONE)				
(6)	31	Azib Skoum (ONE)				
(7)	80	Ameghras (ONE)	Ameghras	Amizmiz		
(8)	108	Tayzelt (ONE)	Sidi Badhaj			
(9)	110	Makhfmane (ONE)				
(10)	111	Tzizifine (ONE)				
3) Number of excluded douars due to newly founded electrification plan of ONE. And replaced or newly proposed by CDER and Heuz Provincial Office during reconnaissance survey.					-3	7
	No.	Excluded douars	Newly proposed	Commune Rurale	Cercle	
(1)	10	Tagadirt N'Ait Ali	Amsakrou	Asni	Asni	
(2)	12	Ouaoueselt	Tinerhouhrine			
(3)	13	Tinfine	El Bour			
(4)	13	-2-	Imskar			
(5)	25	-2-	Oumnas	Tamesloht	Tahanaout	
(6)	26	-2-	Bouchiha Ben Omar			
(7)	113	-2-	Assaka	Ait Aadel	Ait Ourir	
4) Number of excluded douars due to the existance of douars was not found during reconnaissance survey.					-3	0
	No.	Excluded douars	Reason of exclusion	Commune Rurale	Cercle	
(1)	64	Baragha	no existence	Dar Jamaa	Amizmiz	
(2)	75	Ait Ali	no existence			
(3)	82	Ighil	duplication with No.81, and combined as Affella Ighil	Ameghras		
5) Number of divided douars due to administrative reason, as confirmed by the Caidat Office					0	3
	No.	Initial douars	Divided douars	Commune Rurale	Cercle	
(1)	83	Agoursouker Aufg	Anfeg	Ameghras	Amizmiz	
	83	-2-	Aguersouak			
(2)	85	Oumast Et Ait Zitoune	Oumast			
	85	-2-	Ait Zitoun			
(3)	87	Zaouit Izlaghan	Zaouit Izlaghan (Dar Brahim Ou Ali)			
	87	-2-				
Total of decrease and increase					-16	10
Balance					-6	
Number of douars for the Inventory Survey					114	
6) Number of newly nominated douars for micro-hydropower scheme at planning stage.					0	1
	No.	Douars	Commune Rurale	Cercle		
(1)	-	Afra	Zeckten	Ait Ourir		
7) Number of excluded douars due to the newest electrification plan of ONE confirmed at final stage of field survey.					-9	0
	No.	Douars	Commune Rurale	Cercle		
(1)	13	El Bour	Asni	Asni		
(2)	25	Oulad Lahjar	Tamesloht	Tahanaout		
(3)	25	Oumnas				
(4)	27	Del El Ain				
(5)	33	Sour Tadrara	Tahanaout			
(6)	105	Igouder	Sidi Badhaj	Amizmiz		
(7)	107	Ait Aamar El Bour				
(8)	109	Chouirige				
(9)	116	Tabant Ighi	Zeckten	Ait Ourir		
Total of decrease and increase					-9	1
Balance					-8	
Number of douars for the Masterplan Study					106	

VOL. I CHAPTER 2
SOCIO-ECONOMIC CONDITIONS

CHAPTER 2 SOCIO-ECONOMIC CONDITIONS

2.1 Socio-economic Conditions of Haouz Province

2.1.1 General Condition of the Study Area

(1) General Conditions

<Location>

Haouz province is at a distance of about 350 km to the south-west from the capital city of Rabat. It is located on the northern slope of the High Atlas. The province has an area of 6,231 km², and most land area consists of the piedmont and the mountainous area of the Atlas.

<Economic Zone>

The province belongs to the Tensift Economic Zone, which is one of seven economic zones of Morocco. Marrakech is an economic center of the Tensift Economic Zone. Population is about 3,547,000 in the Tensift Economic Zone, which is about 14% of the national population of about 26,074,000.

<Population and Population Density>

Population of Haouz province is 434,810 as of 1994, which is equivalent to 12% of the population of the Tensift Economic Zone, or 1.7% of the national population. Population density is 70/km² in the province, which is a lower density than that of the Tensift Economic Zone of about 92/km².

The province is administratively divided into 4 cercles, which are Asni, Tahanaout, Amizmiz and Ait Ourir. Ait Ourir is the largest cercle in the province, which accounts for about 40% of the land area of the province. Population density is least at 33/km² in Asni, which is less than half of the average density of the province.

Table 2.1-1 Area, Households, Population and Population Density of Haouz Province (1994)

Cercle	Area(km ²)	Population	Households	Population Density (Persons/km ²)
Asni	1,547 (24.8%)	51,435 (11.8%)	7,904 (11.7%)	33.2
Tahanaout	1,128 (18.1%)	99,471 (22.9%)	15,839 (23.5%)	88.2
Amizmiz	1,074 (17.2%)	60,127 (13.8%)	10,617 (15.7%)	56.0
Ait Ourir	2,482 (39.8%)	223,777 (51.5%)	33,084 (49.1%)	90.2
Total	6,231 (100%)	434,810 (100%)	67,444 (100%)	69.8

(Note: Areas of commune rurales are shown in Table 2.1-2)

<Industrial and Electrical Power Situation>

Agriculture and stock raising are the dominant industries in the province. Mines and tourism follow agriculture and stock raising, but they are positioned in less importance. Most of the province area belongs to the mountainous area, where many villages are isolated due to difficult access. These villages are not only isolated from markets and outside civilization but from electricity service as well. The villagers are, therefore, forced to depend on battery for electrical power and must travel a difficult route to the town for battery recharge.

<Education and Language>

The dominant dialect is Berbere in Haouz Province, so that the national language, Arabic, is sometimes not understood by villagers in the province. The province is behind in education, due to a high ratio of persons with no education. Ratio of population with no education is about 70% in the province, being especially high for females at about 90%. Although the government has given priority to improvement of the education ratio especially among females, however, satisfactory levels have not yet been achieved. School attendance is about 50% among boys, and less than 30% among girls as a result of the socio-economic survey.

(2) Number of Communes Rurales and Urban Areas within the Study Area

The breakdown of numbers of communes rurales and urban areas within each of the 4 cercles of Haouz province is given below.

Cercle	Asni	Tahanaut	Amizmiz	Ait Ourir	Total
No. of communes rurales:	7	6	10	15	38
Urban areas:	--	1	1	1	3

Breakdown of land area by commune rural and urban area is given in the following table.

**Table 2.1-2 Areas of Cercle and Commune Rurale in the Study Area
(according to 1994 administrative boundaries)**

Cercles	Area (km ²)							
	Asni	Area	Tahanaout	Area	Amizmiz	Area	Ait Ourir	Area
Commune Rurale	Aghbar	145	Moulay Brahim	95	Amghras	89	Abadou	115
	Asni	234	Oukaimeden	64	Amizmiz	90	Ait Aadel	119
	Ighil	197	Ourika	177	Anagal	91	Ait Faska	96
	Ijoukak	276	Setti Fadma	295	Azgdour	174	Ait Ikim Ait Izid	184
	Imgdal	233	Tahanaout	250	Dar Jamaa	99	Ait Sidi Daoud	122
	Ouirgane	162	Tameskohte	246	LallaTakerkoust	117	Ghmate	95
	Talat N'Yacoub	300			Ouazguita	94	Iguerferouane	92
					Oulad Mtaa	116	Sidi Abdallah Ghiat	174
					Sidi Bedhaj	157	Tamaguert	101
					Tizguine	46	Tamazouzte	57
							Tazart	204
							Tidili Mestieoua	169
							Tighedouine	427
						Touama	124	
						Zerkten	382	
		1,547		1,127		1,073		2,461
Urban Area			Tahanaout	1	Amizmiz	1	Ait Ourir	21
Total		1,547		1,128		1,074		2,482
Total of Province						6,231		

(Note: measured on 1/100,000 map by JICA Study Team in accordance with the administrative boundaries informed by CDER.)

(3) Topographical Classification of the Study Area

From the aspect of topography and altitude, the Study area is divided into four (4) categories, i.e. flat, piedmont, the hilly and the mountainous lands. Study villages were accordingly classified according to these categories

This classification take into consideration the classification by the "Monographie de la Province d'Al Haouz, 1996"

Land Classification by the Monographie d'Al Haouz, 1996 (reference material)

<u>Land Zones</u>	<u>Altitude / Location</u>
Haouz Plain	500 - 600 m
Dir Zone	Alluvial fan of the Zate, the Orika, the Righaya and the N'fis rivers
Sub-Atlasic Zone	1,000 - 1,500 m (Lower mountainous zone)
Medium Mountainous Zone	1,500 - 2,500 m
Axial Zone	Ranges of 3,000 m (Peak: 4,167 m Toubkal)

The flat land is further classified into flat and gully erosion lands from aspect of erosion conditions. The study douars will be further analyzed under such classification taking accessibility and irrigation conditions into consideration.

Table 2.1-3 General Features of the Study Area

Topography Altitude (m)	Slope Natural Vegetation Erosion & Soils	Drinking Water Irrigation Water	Access Road Conditions	Agriculture
Flat Land 500 m - 1,000 m	Slope: very flat, or gentle Natural vegetation: almost none Erosion: some gully Soils: fertile	Drinking water: mainly by water tank, and by wells as supplementary. Irrigation water: by medium scale irrigation from river	generally no problem	Major products: olives, grapes, livestock
Piedmonts 1,000 m - 1,100 m	Slope: steep Natural vegetation: scarce Erosion: Gully erosion Soils: fertile	Drinking water: mainly by piedmont springs. Irrigation water: irrigation canal from piedmont springs Hydraulic potential: very limited	footpaths are used; however, where distance is over 2 km, access is poor	Major products: cereals, olives, livestock
Hilly Land 1,100 m - 1,500 m	Slope: steep Natural vegetation: slight Erosion: some landslides Soils: fertile	Drinking water: mainly by springs Irrigation water: available even in summer; irrigation canal from the springs; hydraulic potential generally limited	pistes are available; however, where the footpaths connecting to these are more than 1 km, access is poor	Major products: cereals, apples, almonds, potato, livestock
Mountainous Land 1,500 m - 2,500 m	Slope: very steep rocky precipice Erosion: weathering and landslides Soils: very limited only at terrace.	Drinking water: mainly by springs. Irrigation water: abundant and available even in summer; irrigation canal from the rivers and springs Hydraulic potential: generally abundant	where pistes are long (over 6 km), and the footpaths connecting to these are more than 1 km, access is poor	Major products: walnut, vegetables, livestock

2.1.2 Population and Households of Haouz Province and the Study Area

(1) Population and Households by the National Census

Population and households of Haouz province were surveyed by the National Census in 1960, 1971, 1982, and 1994.

According to the above reports, the population of Haouz province reached 434,810 in 1994 as shown in Table 2.1-4, of which rural population accounted for 401,326. The rural population is equivalent to 92% of the total population. Total households reached 67,444 in 1994, and average members of one household are 6.6 persons in rural areas, 5.2 in urban areas, and 6.4 on average. A family size is generally larger in rural area. The proportion of the urban population increased from 3% in 1960 to 8% in 1994. Average family size of the province showed an increase from 6.0 persons to 6.4 in same period.

Table 2.1-4 Changes of Population and Households in Haouz Province from 1960 to 1994

	Population				Households		
	1960	1971	1982	1994	1971	1982	1994
Rural	362,629	423,963	383,591	401,326	70,701	60,100	61,035
Urban	10,259	16,551	22,547	33,484	3,278	4,352	6,409
Total	372,888	440,514	406,138	434,810	73,979	64,452	67,444
Proportion	Average members/household						
Rural	97%	96%	94%	92%	6.0	6.4	6.6
Urban	3%	4%	6%	8%	5.0	5.2	5.2
Total	100%	100%	100%	100%	6.0	6.3	6.4

(Data Source: Direction des Statistiques: 1971, 1982, 1994)

(2) Changes in the Number of Communes Rurales in the Four Cercles of Haouz Province

As indicated below, the administrative demarcation of communes rurales has changed from year to year, with a resultant change as well in the population and number of households counted within each cercle.

As a result, population and household numbers in the 4 cercles of the Study area cannot be effectively correlated on the basis of year to year data.

Table 2.1-5 Changes in Numbers of Communes Rurales in each Cercle

4 cercles	Changes in communes rurales			Remarks
	1971	1982	1994	
① Ait Ouril	17	9	16	names of commune rurales have been changed resulting in 16 at present
② Amizmiz	10	10	10	transfer of villages from ② to ③
③ Asni	0	0	7	new villages incorporated from outside Haouz Province, in addition to shift of villages from ② and ④
④ Tahanout	0	6 (addition of a part of Cercle Marrakech Banlieue)	6	shift of villages from ② plus new village demarcation

(3) Growth of Population and Households

In accordance with the composition of commune rurales as in Table 2.1-5, changes of population and households are reported by the Direction des Statistiques as shown in Table 2.1-6. Under this Study, the most recent data comprising that for 1982-1994 was adopted as per below.

Base growth rate:

Population growth rate: province overall = 1.51%; region = 1.37%; urban area = 3.35%
Household growth rate: province overall = 1.42%; region = 1.24%; urban area = 3.28%

Table 2.1-6 Changes of Population and Households in Haouz Province from 1960 to 1994

Census Year	Population					Households				
	1960	1971	1971	1982	1982	1994	1971	1982	1982	1994
Rural Population	(*1)		(*2)		(*3)				(*3)	
Ait Ourir	207,051	243,370	145,780	182,131	181,375	211,615	39,397	27,262	27,135	30,919
Amizmiz	74,447	83,496	83,496	94,680	47,649	51,142	14,708	16,170	7,950	8,804
Asni	-	-	-	-	40,712	51,435	-	-	6,341	7,904
Tahanaout	81,131	97,097	97,097	106,780	71,097	87,134	16,596	16,668	11,195	13,408
Sub-total	362,629	423,963	326,373	383,591	340,833	401,326	70,701	60,100	52,621	61,035
Urban Population										
Ait Ourir	6,223	11,174	4,034	6,079	6,079	12,162	2,213	1,103	1,103	2,165
Amizmiz	4,036	5,377	5,377	5,853	5,853	8,985	1,065	1,202	1,202	1,813
Asni	-	-	-	-	-	-	-	-	-	-
Tahanaout	*	*	*	10,615	10,615	12,337	*	2,047	2,047	2,431
Sub-total	10,259	16,551	9,411	22,547	22,547	33,484	3,278	4,352	4,352	6,409
Total Population										
Ait Ourir	213,274	254,544	149,814	188,210	187,454	223,777	41,610	28,365	28,238	33,084
Amizmiz	78,483	88,873	88,873	100,533	53,502	60,127	15,773	17,372	9,152	10,617
Asni	-	-	-	-	40,712	51,435	-	-	6,341	7,904
Tahanaout	81,131	97,097	97,097	117,395	81,712	99,471	16,596	18,715	13,242	15,839
Total	372,888	440,514	335,784	406,138	363,380	434,810	73,979	64,452	56,973	67,444
	Growth Rate of Population (%/year)					Growth Rate of Households				
Census Year	1960	1971	1971	1982	1982	1994	1971	1982	1982	1994
Rural Population	(*1)		(*2)		(*3)				(*3)	
Ait Ourir		1.48%		2.04%		1.29%		-3.29%		1.09%
Amizmiz		1.05%		1.15%		0.59%		0.87%		0.85%
Asni		-		-		1.97%		-		1.85%
Tahanaout		1.65%		0.87%		1.71%		0.04%		1.51%
Sub-total		1.43%		1.48%		1.37%		-1.47%		1.24%
Urban Population										
Ait Ourir		5.47%		3.80%		5.95%		-6.13%		5.78%
Amizmiz		2.64%		0.77%		3.64%		1.11%		3.48%
Asni		-		-		-		-		-
Tahanaout		*		*		1.26%		*		1.44%
Sub-total		4.44%		8.27%		3.35%		2.61%		3.28%
Total Population										
Ait Ourir		1.62%		2.10%		1.49%		-3.42%		1.33%
Amizmiz		1.14%		1.13%		0.98%		0.88%		1.25%
Asni		-		-		1.97%		-		1.85%
Tahanaout		1.65%		1.74%		1.65%		1.10%		1.50%
Total		1.53%		1.74%		1.51%		-1.25%		1.42%

(Data Source: Direction des Statistiques (Marrakech))

(Notes)

- 1) (*1) corresponding to the figures in the same administrative boundary of the 1971 census taking into consideration estimated figures for 1960.
- 2) (*2) corresponding to the figures in the same administrative boundary of the 1982 census taking into consideration estimated figures for 1971.
- 3) (*3) corresponding to the figures in the same administrative boundary of the 1994 census taking into consideration figures for 1982.

2.1.3 Industries in Haouz Province

(1) General Features of Industry in Haouz Province

Agriculture and stock raising are the dominant industries, while commerce and mining are minor in Haouz province. Average annual income per household is estimated at DH 29,000 in the Study villages, of which agriculture and stock raising account for 46% and 32%, (total of 78%) respectively based on the socio-economic survey carried out by the Study Team. Other industry share is 22% of the said income.

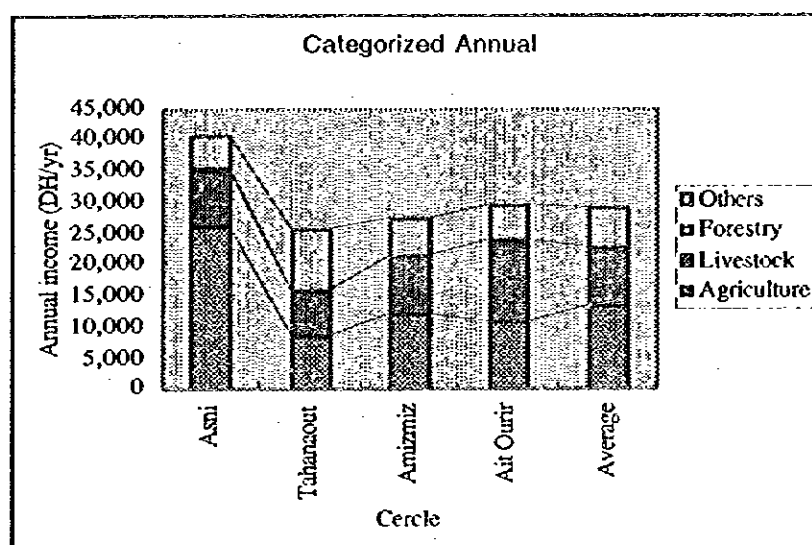


Figure 2.1-1 Income Composition in the Study Villages

Table 2.1-7 Annual Income of the Study Villages by Cercle

Cercle	Income of Each Category (DH/yr)				Total Income
	Agriculture	Livestock	Forestry	Others	
Asni	26,308	8,980	65	5,252	40,604
Tahanaout	8,783	7,257	0	9,798	25,838
Amizmiz	12,057	9,485	45	5,834	27,421
Ait Ourir	10,809	13,078	69	5,538	29,494
Average	13,397 (46%)	9,357 (32%)	43 (0.1%)	6,297 (21.6%)	29,094 (100%)
Asni	64.8%	22.1%	0.2%	12.9%	140%
Tahanaout	34.0%	28.1%	0.0%	37.9%	89%
Amizmiz	44.0%	34.6%	0.2%	21.3%	94%
Ait Ourir	36.6%	44.3%	0.2%	18.8%	101%
Total	46.0%	32.2%	0.1%	21.6%	100%

(Data Source: JICA Study Team Socio-economic Survey, July, 1996)

Average working members per household is 3.3 persons in the Study villages according to the socio-economic survey, of which 2.4 persons are employed in the agriculture sector and 0.9 to non agricultural sectors. Ratio of working member composition is 73% for agriculture and 27% for non agriculture. Ratio of non agriculturally employed household members of 27% is higher than the income ratio for the same at 22%.

(2) Agriculture and Forestry

<Agriculture>

As shown in Table 2.1-7, agriculture accounts for the highest percentage (46%) of total household income. Agricultural land is reported at 127,740 ha by "Monographie de la Province d'Al Haouz, 1996", which is 20.5% of the total area of the province of 6,231 km². Major crops in the province are cereal crops such as wheat and barley, and tree crops such as olive, almond and apples.

Cereal crops account for the largest cropped area of 95,510 ha which is 69% of total agricultural land. Barley is at 72% while wheat is at 28%. Tree crops follow cereal crops at 34,340 ha which is 25% of agricultural land.

Most agricultural households (87%) in the province are reported to have land holdings of less than 5 ha as shown in Table 2.1-8. Household agricultural land holdings in the Study area average 4.42 ha per (see Table 2.1-9).

Table 2.1-8 Agricultural Land Holding in Haouz Province

Land holding (ha)	Households (%)
less than 5 ha	86.8
5 - 10	9.2
10 - 20	2.6
20 - 50	1.0
over 50 ha	0.4

(Data Source: Monographie de la Province d'Al Haouz, Feb, 1996)

Table 2.1-9 Land Holding in the Study Villages

Cercle	Land Holdings per Household (ha)				Total
	Cultivated	Fallow	Pasture	Abandoned	
Asni	1.25	0.47	0.07	0.08	1.88
Tahanaout	3.14	0.26	0.20	0.06	3.67
Amizmiz	4.52	0.27	0.30	0.09	5.18
Ait Ourir	3.04	0.31	0.16	0.06	3.58
Total	3.79	0.30	0.25	0.09	4.42

(Data Source: Socio-economic Survey, July 1996)

Gross income from major crops in Haouz Province is as indicated below (computed on the basis of farm gate prices and production cost).

Table 2.1-10 Gross Income from Major Crops

Cereals:	DH 2,400 /ha
Legumes:	DH 8,750 /ha
Vegetables:	DH 10,000 /ha
Potatoes:	DH 8,750 /ha
Olives and almond:	DH 3,800 /ha
Apples and other fruits:	DH 24,000 /ha

<Livestock Raising>

Livestock raising is one of the most important industries in addition to agriculture in the province. As shown in Table 2.1-7, livestock raising accounts annually for about DH 9,400 which is 32% of the total income of a household in the Study villages. It is reported that livestock of about 535,000 head were kept in the province as a whole in the agricultural year 1994/95. This comprises cattle of about 74,000 head, sheep of 262,000 head, goats of 153,000 head, and mules or donkeys of 47,000 head, as shown in Table 2.1-11, which are equivalent to 1.2, 4.3, 2.5 and 0.8 head per household, respectively, taking a provincial number of rural households of 61,035 into consideration. The average number of livestock per household province-wide is considerably smaller than that of Study villages which as indicated in Table 2.1-12. This reflects the high dependency of the Study villages on livestock raising.

Table 2.1-11 Number of Livestock in Haouz Province

Livestock	Number (head)		Composition (1994/95)	Per Household
	1993/94	1994/95		
Cattle	71,400	73,830	13.8%	1.2
Sheep	257,500	261,900	48.9%	4.3
Goats	150,000	153,000	28.6%	2.5
Donkey, Mule	46,200	46,661	8.7%	0.76
Total	525,100	535,391	100.0%	8.8

(Data Source: Monographie de la Province d'Al Haouz 1996.)

Table 2.1-12 Average Number of Livestock per Household in the Study Village

Cercle	Average Number of Livestock kept by one Household									Total
	Cattle	Sheep	Goat	Mule/ Donkey	Sub-total	Poultry	Horse	Camel	Others	
Asni	1.73	10.73	18.13	0.81	31.40	17.56	0.01	0.00	0.00	48.97
Tahanaout	1.79	9.94	5.65	1.08	18.46	11.29	0.06	0.00	0.00	29.81
Amizmiz	1.99	11.09	9.04	1.29	23.41	12.93	0.05	0.00	0.14	36.53
Ait Ourir	2.74	18.33	21.83	0.84	43.74	8.89	0.03	0.00	0.00	52.66
Average	1.98	11.39	10.67	1.16	25.20	13.02	0.04	0.00	0.09	38.35

(Note: surveyed by Socio-economic survey in 1996.)

Present condition of livestock product value in the Study villages is summarized in Table 2.1-13.

Table 2.1-13 Production Value of Livestock per Household in the Study Area

Cercle	Cattle			Sheep			Goat			Poultry			Milk			Egg			Total
	Sales Ⓞ	Self-consumption Ⓞ	Total Ⓞ + Ⓞ	Ⓞ	Ⓞ	Ⓞ + Ⓞ	Ⓞ	Ⓞ	Ⓞ + Ⓞ	Ⓞ	Ⓞ	Ⓞ + Ⓞ	Ⓞ	Ⓞ	Ⓞ + Ⓞ	Ⓞ	Ⓞ	Ⓞ + Ⓞ	
Asni	4,845	-	4,845	1,470	297	1,767	2,462	306	2,768	19	139	158	83	1,336	1,419	100	352	452	11,409
Tahanaout	4,413	55	4,468	1,609	221	1,830	741	98	839	6	94	100	489	1,042	1,531	-	300	300	9,068
Amizmiz	4,611	116	4,727	1,919	322	2,241	978	144	1,122	12	58	70	1,933	1,458	3,421	31	177	208	11,789
Ait Ourir	7,024	-	7,024	3,249	491	3,650	2,684	336	3,020	-	64	64	163	1,720	1,873	18	198	216	15,847

Farm gate prices for livestock products (cattle: DH 4,700/head; sheep: DH 340/head; goat: DH 280/head; poultry: DH 30/bird; milk: DH 2.90/liter; eggs: DH 0.90/egg)

<Forestry>

Forest covers an area of about 2,723 km² in the province, that is quite large at 44% of the total provincial area of 6,231 km². Forest is administered by "Service Forestier de Marrakech (Forest Service of Marrakech)" in the province. It is reported that an area of 603 km² or 22% of the forest area is deforested due to human activities or natural activities such as landslide, in response to which the Forest Service of Marrakech undertakes efforts such as reforestation to preserve forest.

Within the Study area, Asni cercle has the highest ratio of forest at 53.5%, followed by Amizmiz, Tahanaout and Ait Ourir cercles, respectively, as shown in Table 2.1-22. Although Ait Ourir cercle has the smallest ratio of forest at 39.9%, it has the largest forest area at 990 km². The most dominant tree species is holm oak, which accounts for more than half of the forest area.

Table 2.1-14 Dominant Trees and Forest Area in Haouz Province

Cercle	Total Area (km ²)	Ratio of Forest (%)	Forest Area (km ²)	Forest Area by Tree Species (km ²)										
				Holm Oak (Chêne vert)	Juniper (Genévriers)	Thuya	Alep pine (Pin d'Alep)	Moroccan indigenous species (Arganier)	Secondary species (Essences secondaires)	Reforestation (Reboisement)	Cypress of Atlas (Cypres de l'Atlas)	Cork oak (Chêne liège)	Defriscement	Bare lands (Vides)
Asni	1,547	53.5%	828	438	142	75	3	0	1	0	21	0	2	133
Tahanaout	1,128	40.0%	451	256	32	9	0	0	0	13	0	0	3	139
Amizmiz	1,074	42.2%	454	254	14	13	10	0	7	0	16	0	27	115
Ait Ourir	2,482	39.9%	990	547	123	43	35	0	0	0	0	1	20	219
Province	6,231	43.7%	2,723	1,566	311	144	47	0	7	13	37	3	51	603
Ratio of Forest Composition														
Asni			100.0%	54.2%	17.2%	9.5%	0.3%	0.0%	0.1%	0.0%	2.5%	0.0%	0.3%	16.0%
Tahanaout			100.0%	56.7%	7.0%	2.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%	0.7%	30.8%
Amizmiz			100.0%	56.0%	3.2%	2.8%	2.2%	0.0%	1.5%	0.0%	3.6%	0.0%	5.9%	24.9%
Ait Ourir			100.0%	55.3%	12.4%	4.4%	3.5%	0.0%	0.0%	0.0%	0.0%	0.3%	2.0%	22.1%
Province			100.0%	55.3%	11.4%	5.3%	1.7%	0.0%	0.3%	0.5%	1.4%	0.1%	1.9%	22.2%

(Data Source) Service Forestier de Marrakech, Direction Provinciale de Marrakech, Ministère de l'Agriculture et de la Réforme Agricole

As shown in Table 2.1-15, annual consumption of firewood is estimated at 2.7 t per household in the Study villages, of which 2.4 t or 88 % is collected from forest. Based on this consumption, total consumption of firewood is estimated at 165,000 t, which is about eight times that estimated by the Forest Service. There is a possibility that much more firewood is actually produced than that estimated by the Forest Service.

Table 2.1-15 Firewood Consumption per Household in the Study Villages

Cercle	Annual Consumption of Firewood (kg/household)			Value of Firewood (DH)	Estimated Consumption in Haouz Province (*)		
	Purchase	Collecting	Total		Rural Households	Firewood (t)	Value (DH 1,000)
Asni	118	3,326	3,444	1,722	7,904	27,221	13,611
Tahanaout	146	3,097	3,243	1,622	13,408	43,482	21,741
Amizmiz	440	1,975	2,415	1,208	8,804	21,262	10,631
Ait Ourir	18	3,023	3,041	1,521	30,919	94,025	47,013
						(185990)	(92996)
Total Villages	326	2,387	2,713	1,357	61,035	165,588	82,794

(Note:

- 1) Price of firewood = DH 0.5 /kg.
- 2) surveyed by Socio-economic Survey, July 1996.
- 3) (*): estimated based on amount per household.)

(3) Industry

Industry is not yet developed in Haouz province, although the province locates favorably from the aspect of suitability of industry such as a close distance from Marrakech. It is reported that industrial production was DH 215 million and that the industrial sector employed 400 workers in the province in 1993.

Table 2.1-16 Industrial Production and the Major Industrial Cooperatives in Haouz Province

Annual Industrial Production :	DH 215 million (in 1993)
Employees :	400 workers (in 1993)
Major Industrial Cooperatives :	
Agro-alimentary Cooperatives	6 cooperatives (including flour milling)
Cheese Manufacturing Cooperatives	1 cooperatives
Industrial Chicken Cooperatives	2 cooperatives
Construction Material Cooperatives	3 cooperatives
Flower Processing Cooperatives	1 cooperatives
Total	13 cooperatives

(Data Source: Monographie de la Province d'Al Haouz, 1996)

As shown in the above table, five industrial cooperatives are associated in the province, of which four cooperatives relate to agriculture and stock raising. Therefore, agriculture and stock raising are important from this aspect.

The handicraft industry reportedly employs 6,000 workers in the province. From the aspect of employment, the handicraft industry is significant for the province.

Table 2.1-17 Handicraft Industry in Haouz Province

Employment :	about 6,000 workers
Composition	Ratio
Repairing	42%
Weaving	20%
Pottery	13%
Joinery	9%

(Data Source: Monographie de la Province d'Al Haouz, 1996)

(4) Tourism

Since Haouz province is rich in natural and leisure resources, many tourists visit the province from local areas and abroad. Major resources are trekking and leisure in summer and skiing in winter in the high Atlas, where Mount Toubkal, the highest peak (4,167 m) in Morocco, locates. These resources are not yet fully developed, and the provincial government plans to develop more resources for tourism.

The number of tourists was 4,500 persons in 1994, of which 82% were foreigner and 18% Moroccan. Among foreigners, French and English were prevalent at 26% and 19%, respectively. Stay is generally short at 1.8 nights per person.

(5) Mines

Major mining of Morocco is the phosphate industry, but no phosphate mines are reported in Haouz province. Major mines of the province are zinc, lead, copper, barium and rock salt. As shown in Table 2.1-18, production of zinc accounts for 82% of national production. Zinc production has increased rapidly in recent years as well as the production of lead and copper. However, production of barium and salt has stagnated. Total value of annual production of mines in the province is estimated at DH 170 million.

Table 2.1-18 Mining Production in Haouz Province and in Morocco

Minerals	Production (t)					Proportion to National	Major Production Mines
	Year	1991	1992	1993	1994		
Haouz							
Zinc		18,028	22,066	119,584	142,800	75,620	82.3% Hajar Mine (between Guemassa and Tahanaout)
Lead		4,206	4,839	24,839	26,598	15,121	14.1% Hajar Mine
Copper		2,328	1,740	9,733	12,973	6,694	18.5% Hajar Mine, Tenfir Mine (near Tlat N Yacoub)
Barium		13,815	24,622	25,497	27,166	30,275	8.3% Tafga, Tichka, Matate and Tinitine Mines
Salt		11,310	11,592	11,407	11,845	11,539	7.2% Imghira, Douar Chems and other 25 deposits
Total		79,687	64,859	191,060	221,332	139,249	18.4%

National Production (Only for Zinc, Lead, Copper, Barium and Salt)					
Zinc	51,491	42,381	125,743	147,800	91,855
Lead	103,374	104,955	114,698	104,513	106,885
Copper	38,952	34,297	35,706	36,010	36,241
Barium	434,660	401,599	349,613	266,000	362,968
Salt	143,921	164,528	150,961	178,594	159,499
Total	772,398	747,760	776,726	732,907	757,448

<Increase of Production (1991=100)>					
Haouz					
Zinc	100	122	663	792	
Lead	100	115	591	637	
Copper	100	75	418	557	
Barium	100	56	58	62	
Salt	100	102	101	105	
Total	100	81	240	278	
National Production					
Zinc	100	82	244	287	
Lead	100	102	111	101	
Copper	100	88	92	92	
Barium	100	92	80	61	
Salt	100	114	105	124	
Total	100	97	101	95	

<Production in Value (1,000DH)>						
Haouz						Composition
Zinc	36,777	47,344	157,366	187,917	107,351	63.1%
Lead	10,685	9,311	31,052	58,350	27,350	16.1%
Copper	11,912	8,947	32,589	52,251	26,425	15.5%
Barium	12,706	3,693	4,334	4,618	6,338	3.7%
Salt	2,785	2,898	2,776	2,110	2,642	1.6%
Total	74,865	72,193	228,117	305,246	170,106	100.0%
National Production						
Zinc	105,040	90,931	165,478	194,497	138,987	
Lead	262,607	201,941	143,387	229,278	209,303	
Copper	199,306	176,360	119,553	145,036	160,064	
Barium	126,650	60,240	59,434	45,220	74,736	
Salt	35,443	41,132	36,740	31,817	36,283	
Total	728,446	570,604	524,592	645,848	619,373	

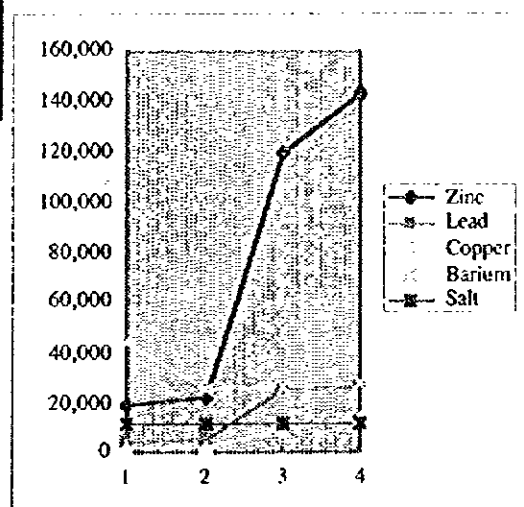
(Data Source)

- 1) Production of Haouz Province: Monographie de la Province d'Al Haouz, Feb. 1996
- 2) National Production: Annuaire Statistique du Maroc 1995, Direction de la Statistique

(Notes)

- 1) Values of zinc and barium are estimated for 1994 using same prices of 1993.
- 2) Values of production of Haouz are estimated using national values.

Mineral Production in Haouz



2.1.4 Present Road Conditions in Haouz Province and in the Study Area

(1) Road Classification

Roads are classified into two categories, namely trunk road and communal road. Trunk roads are under the responsibility of the Ministry of Public Works, and communal roads under the Commune Rurale. Roads are further classified based on importance and function. The classification and function of roads in Haouz Province is as follows: (see Figure 2.1-5)

<Road Classification>

Trunk Roads (under responsibility of Ministry of Public Works)

- 1) National Road (Route Nationale): between principal large cities like Casablanca and Marrakech.
- 2) Regional Road (Route Regionale): between regional principal city and municipal towns like Marrakech-Asni, Tahanaout, Amizmiz and Ait Ourir.
- 3) Provincial Road (Route Provinciale): between Commune Rurales, freely passable by vehicle and mostly paved.

Communal Roads (under responsibility of Commune Rurale)

- 1) Piste Roads (Les Pistes): passable by a vehicle, but not paved.
- 2) Tertiary Roads (Les Chemins Tertiars): passable by cart.
- 3) Footpath (Les Sentiers): passable by foot or by mule or a donkey.

(2) Main Factors regarding Accessibility

Among the above roads, the communal roads play a more important role than the trunk roads in access to the remote villages. The length of trunk road is not a main factor in accessibility to the villages, because public transportation is available on the trunk road. Consequently, the distance of the communal road is a main factor to determine the accessibility to the villages. From this aspect, the distances of the piste and tertiary roads and the footpaths have been measured to each village by means of field reconnaissance and tracing the route on 1: 50,000 scale topomapping. No tertiary road was found on any routes to the Study villages. The roads to the villages are composed of only piste roads and/or footpaths.

(3) Accessibility to Villages

Accessibility has been analyzed taking the altitude into consideration as well as distance, because the road conditions become generally worse with the increase of altitude. Accessibility is evaluated by the length of piste road and footpath as well as altitude, because the trunk road is not a main factor constraining accessibility to villages from the aspects of availability of public transportation, capacity and speed.

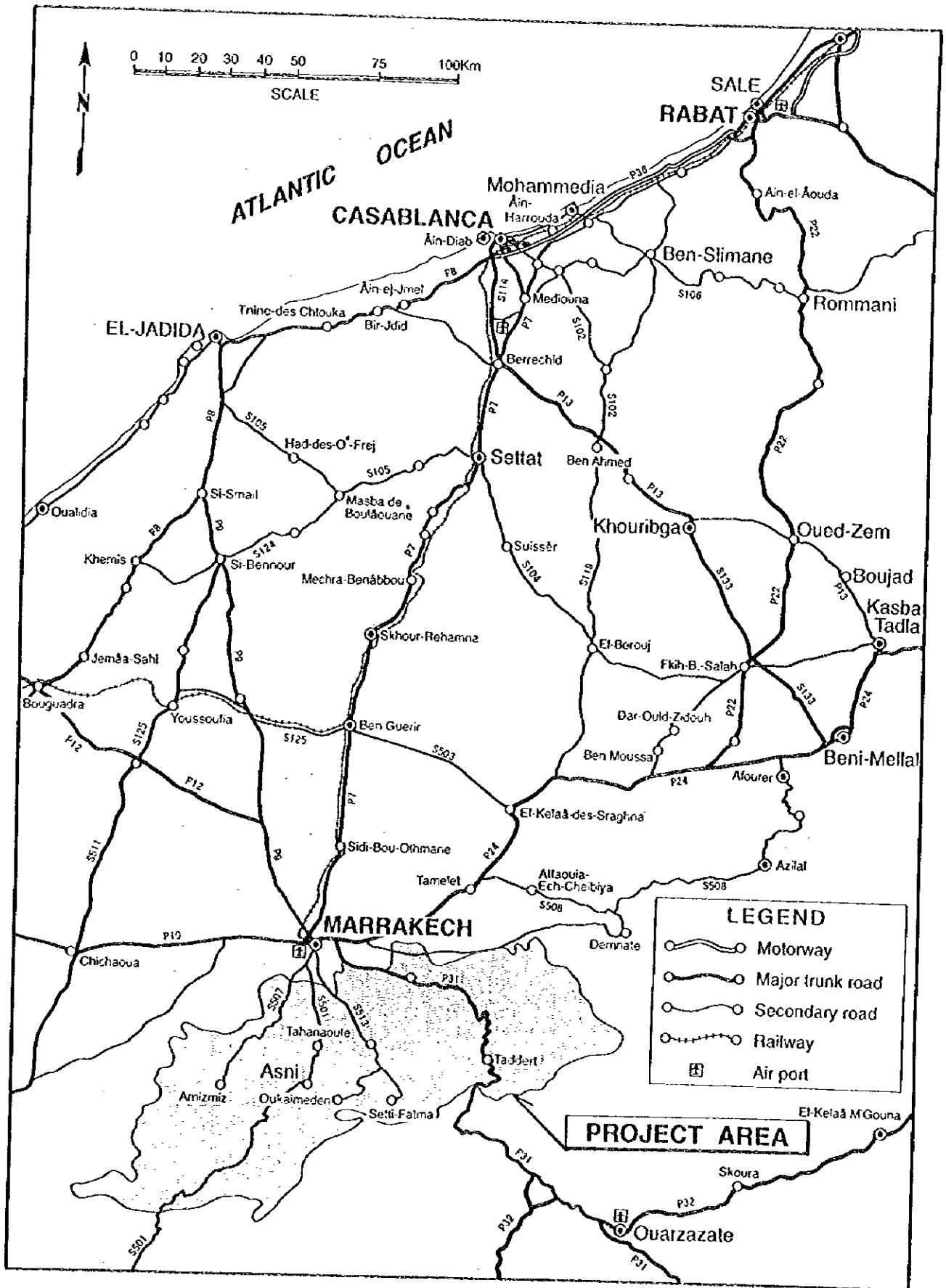


Figure 2.1-2 Road Network in the Study and Surrounding Area

2.1.5 Social Conditions in Haouz Province

(1) Public Water Supply

Provision of public water supply is under the responsibility of "Office Nationale de l'Eau Potable (ONEP)". However, ONEP is only responsible for urban area, so that no public water supply systems have been provided in the rural area. Consequently, villagers must prepare their own water supply systems privately or jointly by means of providing wells or conveying water from streams and springs. In the flat area or piedmont area where water source including groundwater is limited, private tanks are constructed under ground to store water for a sufficiently long period. However, these are limited in capacity and quality of water under this method, and as a result severe water shortages are sometimes experienced. Due to varying tank capacity, there are cases where one household will some surplus may provide water to a household facing water shortage.

(2) Education

Education cycle in Morocco is from the 16th of September to the next 15th of September. The education system was revised recently as shown in Table 2.1-19. Although the first cycle of primary school is obligatory, attendance rate has not yet reached 100%. In the Study villages, attendance rate remains presently at 41%. Koranic schools are provided for children before primary school to teach them to read Arabic in order to understand the Koran. There are primary or Koranic schools in 70% of the villages in the Study area.

Table 2.1-19 Education System in Morocco (as of 1996)

Schools	Education Years	Ages for Education		Obligation	Remarks
		Enter	Graduated		
Koranic school (L'e'cole coranique)	3 to 4 yrs	>= 2 yrs	>= 5 or 6 yrs	none	<public>
Preschool (Le pre'scolaire moderne)	3 to 4 yrs			none	<private>
Primary school - first cycle (L'enseignement fundamental - 1er)	6 yrs	6 yrs	12 yrs	obliged	<public>
Primary school - second cycle (L'enseignement fundamental - 2e'me)	3 yrs	12 yrs	15 yrs	obliged	<public>
Secondary school (L'enseignement secondaire)	3 yrs	F. S. -2nd Cycle to be graduated		none	<public> to obtain a bachelor degree after graduation.
University (L'enseignement supe'riur)	1st cycle: 2 yrs 2nd cycle: 2 yrs DES: 3yrs	to be a bachelor scholar.		none	

(Notes: DES: Diplome d'Etudes Superieurs)

Table 2.1-20 shows the education rate and the attendance rate of the primary schools in the Study villages. Education rate is 29% for the Koranic schools and 21% for the primary school first cycle, and the no education rate reaches 71%. Attendance rate of children, however, reaches 41% at present. This means that the education rate has been much improved. However, it will be necessary to improve the education rate further, especially, in Ait Ourir, because its education rate for children is much lower at 19%. From the aspect of sex, the no education rate of female is much high at 87%, while the same is 52% for male. There is also a difference in attendance rate of children between female and male at 28% for the former and 52% for the latter. The provincial government is moving forward with a plan to improve the female attendance rate in the province. It is expected that the female attendance rate will experience a rapid increase

Table 2.1-20 Education Rate and Attendance Rate in the Study Villages

Cercle	Average Family Size	Education Ratio for Over 7 yrs old				Education Ratio of Male				Education Ratio of Female			
		Education Ratio			Child (7-12yrs)	Education Ratio			Child (7-12yrs)	Education Ratio			Child (7-12yrs)
		Koranic	Fund	None		Koranic	Fund	None		Koranic	Fund	None	
Asni	7.2	27%	18%	74%	44%	40%	23%	60%	62%	10%	10%	90%	27%
Tahanaout	7.4	39%	29%	61%	56%	54%	33%	46%	62%	20%	18%	80%	47%
Amizmiz	7.6	28%	20%	72%	42%	44%	29%	57%	58%	11%	10%	89%	25%
Ait Ourir	7.2	22%	15%	78%	19%	26%	16%	75%	14%	18%	13%	82%	25%
Average	7.5	29%	21%	71%	41%	43%	29%	55%	52%	13%	11%	87%	28%

(Note) surveyed by Socio-economic survey in June 1996.

2.2 Socio-economic Conditions of the Study Villages

2.2.1 Study Villages

Through the several meetings with CDER and the concerned organizations such as the ONE and the Haouz Provincial Office, the number of Study villages was reduced from the original 120 to 114. Major changes from CDER's initial plan are summarized as follows;

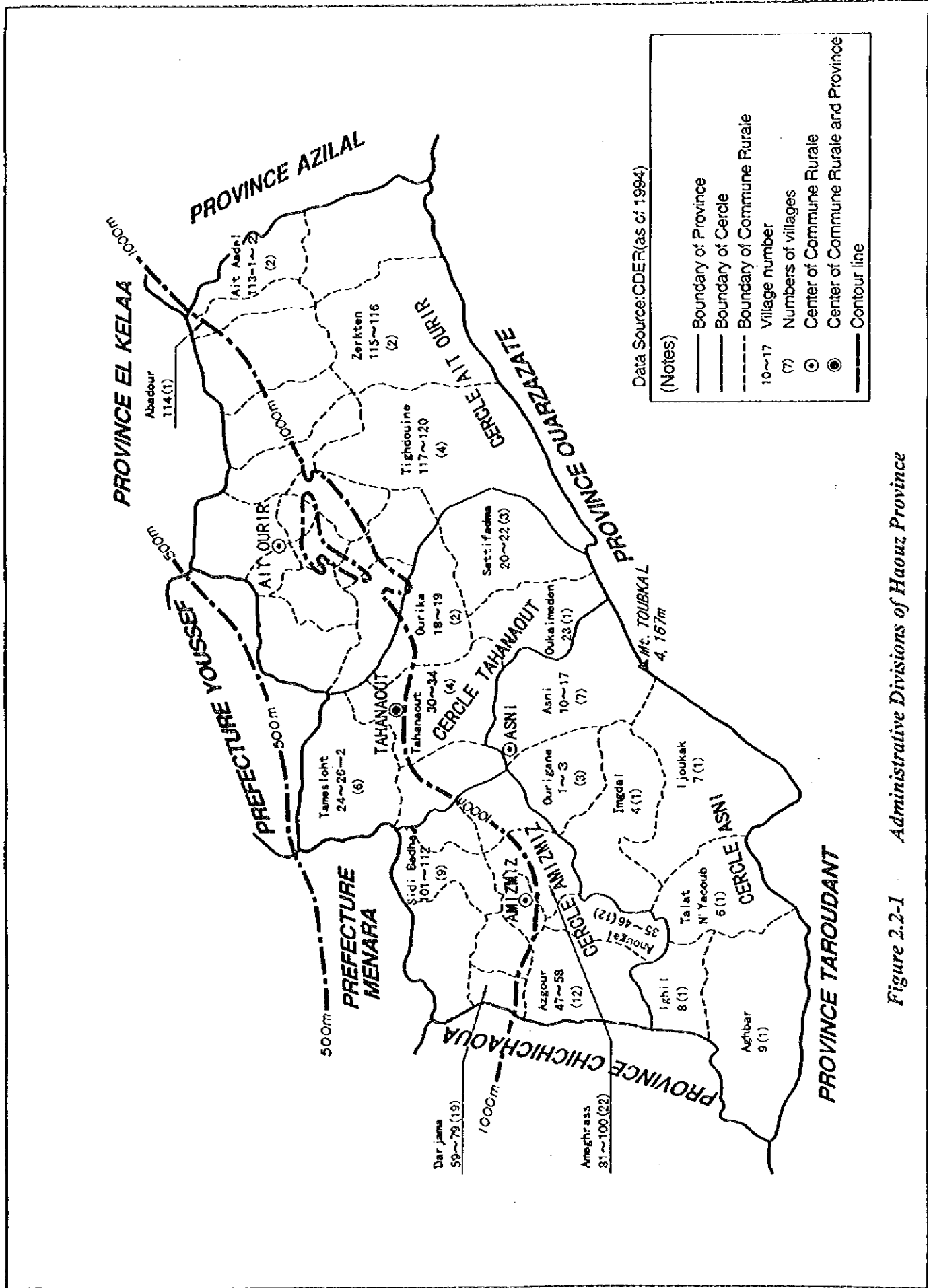
	CDER Initial Plan	Study Villages
Villages	120	114 (-6)
Households	8,219	7,272 (-947)
Population	49,305	45,556 (-3,749)

2.2.2 Distribution of the Study Villages

As shown in Table 2.2-1, Amizmiz Cercle accounts for a large portion of the Study villages, i.e. 74 villages out of 114 villages or 65 % of the total. Cercles Tahanaout, Asni and Ait Ourir account for 16 villages (14 %), 15 villages (13 %) and 9 villages (8 %), respectively. Locational distribution of the villages is illustrated in Figure 2.2-1.

Table 2.2-1 Distribution of the Study Villages

Cercles											
Asni/ Commune Rurale	Do- uar Nbr	Ratio to Total	Tahanaout /Commune Rurale	Do- uar Nbr	Ratio to Total	Amizmiz /Commune Rurale	Do- uar Nbr	Ratio to Total	Ait Ourir /Commune Rurale	Do- uar Nbr	Ratio to Total
Ouirgane	3	2.6%	Ourika	2	1.8%	Anougal	12	10.5%	Ait Aadel	2	1.8%
Imgdal	1	0.9%	Settifadma	3	2.6%	Azgour	12	10.5%	Abadour	1	0.9%
Talat N'Yacoub	1	0.9%	Oukaimede	1	0.9%	Dar Jamaa	19	16.7%	Zerkten	2	1.8%
Ijoukak	1	0.9%	Tamesloht	6	5.3%	Ameghrass	22	19.3%	Tighdouine	4	3.5%
Ighil	1	0.9%	Tahanaout	4	3.5%	Sidi Badhaj	9	7.9%			
Aghbar	1	0.9%									
Asni	7	6.1%									
	7	13.2%		5	14.0%		5	64.9%		4	7.9%
Total Commune Rurals = 21			Douars = 114								



Data Source: CDER (as of 1994)

- (Notes)
- Boundary of Province
 - Boundary of Cercle
 - - - Boundary of Commune Rurale
 - 10~17 Village number
 - (7) Numbers of villages
 - ⊙ Center of Commune Rurale
 - ⊙ Center of Commune Rurale and Province
 - Contour line

Figure 2.2-1 Administrative Divisions of Haouz Province

2.3 Questionnaire Survey

2.3.1 Execution of Questionnaire Survey

(1) Methodology of the Questionnaire Survey

In order to identify the socio-economic conditions prevailing in the Study area, the JICA Study Team carried out a questionnaire survey.

Questionnaire contractor:	Maghreb Projets
Survey period:	June ~ July 1996
Survey villages:	113 villages (households: 7,227; population: 45,169)
Questionnaire to Village Leaders:	113
Questionnaire to Households:	992 (13.7% of total)

(2) Major Items of the Questionnaire Survey

Major items of the questionnaire are summarized as below;

< Questionnaire to the Village Leader >

- 1) Population of the village and its composition by age and sex
- 2) Existing organizations and relation of family groups in the village
- 3) Number of households by occupation
- 4) Land holdings of village
- 5) Cropped area and production (including selling rate)
- 6) Number of livestock and production (including selling rate)
- 7) Production of forestry
- 8) Manufacturing in the village
- 9) Purpose of utilization of electricity
- 10) Environment conservation especially for forests
- 11) Number of public facilities such as school, public hall, first aid hospitals, etc.
- 12) Fuels in the village and its importance
- 13) Diffusion rate of electric equipment in the village
- 14) Desired electrification level
- 15) Payable cost by household for electrification
- 16) Water sources for drinking water and irrigation
- 17) Opinion on utilization of irrigation water for hydro-power generation

< Questionnaire to the Chief of Household >

- 1) Family composition and education level and engaged work of each member
- 2) Composition of house
- 3) Income and saving
- 4) Land holding
- 5) Cropped area and production (including marketing rate)
- 6) Number of livestock and production (including marketing rate)
- 7) Production of forestry
- 8) Energy and expenditure for house keeping
- 9) Existing electric equipment (radio, TV)
- 10) Desired electric equipment and utilization hours

- 11) Payable investment cost and monthly cost for electrification
- 12) Water source for drinking water and irrigation
- 13) Transport labor for carrying drinking water

(3) Software for Compilation and Methodology of Creation of Inventory

The results of the questionnaire survey have been compiled by SPSS software by the Contractor. After input of the data, necessary data was then transferred to an EXCEL file for data analysis and creation of inventory. In the inventory, additional information has been given such as elevation, topography, location, accessibility of road, and distance from the existing power lines as well as data from the questionnaire survey.

The inventory was compiled on a village-wise basis for 114 villages, and is based on a code assignment for each cercle, commune rurale and village. Inventory items are as follows:

- Electrification
- Socio-economy and environment
- PV generation facilities
- Micro-hydropower facilities
- Diesel generation facilities

2.3.2 Results of Questionnaire Survey

Results of questionnaire survey for the 992 sampled households in the Study villages were collated according to the following categories, and applied as base data for the Study.

- (1) Analysis of household and houses
- (2) Analysis of household budget and occupations
- (3) Analysis of energy consumption
- (4) Electricity related analysis
- (5) Analysis of drinking water and irrigation water
- (6) Analysis of natural conditions and disasters
- (7) Analysis of environmental aspects
- (8) Public and industrial facilities

Analysis of the above items is described below.

2.3.3 Analysis of Findings of Questionnaire Survey

(1) Analysis of Household and Houses

Table 2.3-2 shows the family size and housing condition of 992 sample households selected from the Study villages. The family size of sample households is 7.47 as shown in the table, which is larger than that of total households of the Study villages. The average family size of total households is estimated at 6.26, based on a population

of 45,556 and 7,272 households. The reason for larger family size of the sample households might be due to the fact big families than normally would have branched into two or more families are still living under the same roof. This is further reflected by the fact that 12.3% households responded that their households comprised more than one dwelling. Average number of rooms and house size of sample households are 6.1 rooms and 204 m² in size. From the aspect of house structure, traditional houses, which are made of rammed-clay and stone, are inhabited by 92.8% households while modern reinforced concrete houses are used by 7.2%. Traditional houses are inhabited by 100% of the households in Asni cercle, but only by 90% in Amizmiz cercle, indicating the difficulty in transportation of construction materials in Asni cercle.

Table 2.3-1 Family Size and House Structure of the Sample Households

Cercle	Family Size	Rooms	House Size (m ²)	Composition of House		House Structure	
				Single	Plural	Modern	Traditional
Asni	7.34	8.0	202	95.0%	5.0%	0.0%	100.0%
Tahanaout	7.32	5.7	250	91.2%	8.8%	2.5%	97.5%
Amizmiz	7.55	5.6	197	85.1%	14.9%	9.8%	90.2%
Ait Ourir	7.25	7.3	188	89.4%	10.6%	6.4%	93.6%
Total	7.47	6.1	204	87.7%	12.3%	7.2%	92.8%

Cercle	Commune Rurale	Family Size	Rooms	House Size (m ²)	Composition of House		House Structure	
					Single	Plural	Modern	Traditional
Asni	Ouirgane	6.68	9.4	227	94.1%	5.9%	0.0%	100.0%
	Imgdal	5.67	7.2	177	83.3%	16.7%	0.0%	100.0%
	Tafat N'Yacoub	8.00	6.8	167	100.0%	0.0%	0.0%	100.0%
	Ijoukak	10.75	10.0	218	87.5%	12.5%	0.0%	100.0%
	Ighit	7.50	8.1	169	100.0%	0.0%	0.0%	100.0%
	Aghbar	5.38	7.5	141	100.0%	0.0%	0.0%	100.0%
Tahanaout	Asni	7.54	7.6	210	95.8%	4.2%	0.0%	100.0%
	Ouirika	6.17	5.4	173	93.3%	6.7%	0.0%	100.0%
	Settifadma	6.68	5.3	117	91.3%	8.7%	0.0%	100.0%
	Oukaimeden	7.00	5.1	288	100.0%	0.0%	8.3%	91.7%
	Tamesleht	7.01	5.2	283	93.8%	6.3%	3.1%	96.9%
	Tahanaout	8.93	7.3	328	84.4%	15.6%	2.2%	97.8%
Amizmiz	Ancugal	7.67	5.9	162	88.5%	11.5%	5.2%	94.8%
	Azgour	7.88	6.4	177	87.2%	12.8%	5.6%	94.4%
	Dar Jamaa	7.06	5.2	182	87.5%	12.5%	9.4%	90.6%
	Ameghrass	7.64	5.2	210	79.6%	20.4%	22.2%	77.8%
	Sidi Badhaj	7.74	6.1	267	79.7%	20.3%	8.9%	91.1%
	Ait Ourir	7.21	8.2	213	70.8%	29.2%	4.2%	95.8%
Ait Ourir	Abadour	7.45	6.4	253	94.3%	5.7%	3.8%	96.2%
	Zerkten	6.75	5.8	202	91.7%	8.3%	11.1%	88.9%
	Tighdouine	7.46	8.1	159	92.9%	7.1%	7.1%	92.9%
Total	7.47	6.1	204	87.7%	12.3%	7.2%	92.8%	
Average								

(Note) surveyed by Socio-economic Survey, July 1996.

(2) Analysis of Household Budget and Occupations

1) Household Income

Income from agriculture and livestock accounts for 78% of total income while 22% is accounted for by non agricultural sectors.

2) Review of Incomes of Agriculture and Livestock

Agricultural income has been reviewed based on land holdings, cropped area and marketing ratio declared by each household and the profitability of crops. On the other hand, livestock income was also reviewed based on marketed livestock and farm gate price for the same. The result of review is shown in Table 2.3-2. On this basis, the average income in the Study villages is computed as shown below (amount for self-consumption has already been deducted).

Agricultural income: DH 13,400/household/year
Livestock income: DH 9,400/household/year

Table 2.3-2 Review of Declared Incomes of Agriculture and Livestock

Cercle	Commune Rurale	Agricultural Income			Livestock Income		
		Declared (DH)	Revised (DH)	Difference (DH)	Declared (DH)	Revised (DH)	Difference (DH)
		22,172	26,308	+4,136	11,243	8,980	-2,263
		8,273	8,783	+510	7,838	7,257	-581
		16,052	12,057	-3,995	9,785	9,485	-300
		14,839	10,809	-4,030	10,633	13,078	+2,445
	Total	15,677	13,397	-2,280	9,763	9,357	-406
Asni	Ouirgane	39,819	44,515	+4,696	8,395	7,187	-1,208
	Imgdal	18,417	56,414	+37,998	18,725	15,753	-2,972
	Talat N'Yacoub	15,280	7,882	-7,398	6,033	7,223	+1,190
	Ijoukak	31,045	9,440	-21,605	16,863	13,298	-3,565
	Ighil	11,093	11,620	+528	19,394	17,047	-2,347
	Aghbar	7,931	8,691	+760	24,606	8,485	-16,121
	Asni	18,479	23,861	+5,382	8,263	7,332	-931
Tahanaout	Ourika	3,772	8,977	+5,205	6,111	6,158	+47
	Seltifadma	3,757	5,089	+1,332	7,190	7,089	-100
	Oukaimeden	1,177	2,150	+973	7,122	7,430	+308
	Tamesloht	11,405	8,810	-2,594	7,169	6,314	-854
	Tahanaout	10,989	13,075	+2,085	10,372	9,305	-1,067
Amizmiz	Anougal	36,583	17,875	-18,708	10,386	9,783	-603
	Argour	20,118	21,391	+1,274	12,242	10,806	-1,436
	Dar Jamaa	8,252	5,631	-2,621	10,942	10,107	-835
	Ameghrass	8,607	8,098	-509	5,665	7,132	+1,467
	Sidi Badhaj	17,923	15,095	-2,827	13,338	11,766	-1,572
Ait Ourir	Ait Abdel	47,323	14,322	-33,002	8,575	8,945	+370
	Abadour	4,889	4,261	-628	4,592	4,785	+194
	Zerkten	7,418	7,484	+67	13,744	10,667	-3,077
	Tighdouine	12,916	13,231	+314	11,103	17,390	+6,287
	Total Average	15,677	13,397	-2,280	9,763	9,357	-406

Note:

- 1) Since there were many cases where there was discrepancy between cropped area and response figures; cropped area for each crop was adjusted for each survey household on the basis of area of land owned, and agricultural income corrected accordingly.
- 2) With regard to the responses for agricultural income, there instances where stated amount far surpassed actual land holdings, and vice versa. In such case, correction was made according to the formula below.

Corrected agricultural income = Σ (corrected cropped area for each crop \times gross income per cropped area for each crop \times marketing rate for each crop)

- 3) Livestock income in the responses is based on sales of livestock and livestock products (milk, eggs). As with agricultural income, these are expressed above after adjustment based on farm gate prices and marketed amounts.

3) Working Members and Family Budget

Table 2.3-3 shows the income and expenditure of households taking into consideration the revised income of agriculture and livestock, as well as non agricultural income.

Table 2.3-3 Household Budget and Working Members

Cercle	Commune Rurale	Working Members			Annual Budgetary Balance			Annual Expenditure of Energy		
		Total	Agri.	Non-agri.	Income (DH)	Expenditure (DH)	Saving (DH)	Fuel (DH)	Electricity (DH)	Total (DH)
Asni		2.63	2.05	0.58	40,604	17,226	23,378	1,708	1,234	2,942
Tahanaout		2.97	1.97	1.01	25,838	13,384	12,455	1,539	1,163	2,702
Amizmiz		3.57	2.67	0.90	27,421	12,751	14,670	1,789	1,166	2,955
Ait Ourir		2.84	2.01	0.82	29,494	15,005	14,490	1,375	1,043	2,419
Total		3.31	2.44	0.87	29,094	13,594	15,500	1,714	1,166	2,880
Asni	Ouirgane	2.66	1.90	0.75	65,028	19,979	45,048	1,817	1,286	3,103
	Imgdal	2.67	2.50	0.17	73,168	22,513	50,654	2,018	1,224	3,242
	Talat N'Yaacoub	2.33	2.00	0.33	17,539	11,825	5,714	1,246	924	2,170
	Ijoukak	4.13	3.50	0.63	23,233	20,625	2,608	1,660	998	2,657
	Ighil	2.38	2.25	0.13	30,230	13,200	17,030	1,448	1,061	2,509
	Aghbar	2.13	1.75	0.38	21,489	17,025	4,464	1,954	1,218	3,172
	Asni	2.56	1.86	0.70	35,474	16,181	19,293	1,692	1,318	3,010
Tahanaout	Ouirika	2.58	1.53	1.06	20,513	11,635	8,878	1,042	976	2,018
	Settifadma	1.82	1.28	0.54	18,022	11,327	6,695	766	880	1,646
	Oukaimeden	2.33	1.67	0.67	10,288	7,329	2,959	966	902	1,868
	Tamesloht	3.06	2.05	1.02	25,180	14,765	10,414	1,600	1,201	2,802
	Tahanaout	4.06	2.65	1.41	39,239	15,242	23,997	2,418	1,477	3,895
Amizmiz	Anougal	3.45	2.60	0.85	33,053	14,065	18,987	1,406	1,273	2,679
	Azgour	3.17	2.20	0.96	37,580	15,228	22,352	2,051	1,236	3,287
	Dar Jamaa	3.55	2.79	0.76	21,288	12,271	9,018	1,809	1,232	3,041
	Ameghrass	3.97	3.06	0.92	17,552	9,414	8,139	1,551	954	2,504
	Sidi Badhaj	3.35	2.20	1.15	43,436	16,865	26,571	2,489	1,313	3,802
Ait Ourir	Ait Aadel	3.79	2.88	0.92	27,537	14,470	13,067	1,195	1,115	2,310
	Abadour	3.40	1.94	1.45	19,146	12,245	6,902	1,562	1,134	2,697
	Zerkten	2.38	1.39	0.98	25,775	16,197	9,578	1,247	1,001	2,248
	Tighdouine	2.69	2.13	0.57	34,430	15,233	19,198	1,438	1,024	2,462
Total Average		3.31	2.44	0.87	29,094	13,594	15,500	1,714	1,166	2,880

As shown in Table 2.3-3, working members are 3.3 persons per household, of which 2.4 work in agriculture including stock raising while 0.9 are employed in the non agricultural sector. Annual total income of Study households is estimated at DH 29,000, and expenditure and savings are DH 13,600 and DH 15,500, respectively.

However, this differs by area and village, for example in the case of communes rurales Ijoukak in Asni and Oukaimeden in Tahanaout annual savings are less than DH 3,000. Accordingly, an appropriate electrification plan should be prepared for each village taking such savings levels into consideration.

(3) Analysis of Energy Consumption

Table 2.3-4 shows the amount of fuel consumption per household. This amounts to 2.7 t of firewood, 25 kg of charcoal, 450 liters of butane gas, 11 liters of petrol, and 900 candles. From this fact, major energy sources are firewood and butane gas in the Study villages. Villagers collect most firewood, 2.4 t at about 90% of total

consumption, by themselves. Small tanks are commonly used for butane gas for convenience of transportation.

Table 2.3-4 Annual Fuel Consumption per household in the Study Villages

Cercle	Annual Consumption of Purchased Fuel							Free Fuel by Collecting		
	Wood (kg)	Charcoal (kg)	Butane Gas (lit)			Petrol (lit)	Candle (pcs)	Wood (kg)	Charcoal (kg)	Candle (pcs)
			lights	fuel	total					
Asni	118	5	178	326	503	7	889	3,326	0	49
Tahanaout	146	21	152	230	382	18	885	3,097	0	37
Amizmiz	440	19	152	309	462	10	837	1,975	13	39
Ait Ourir	18	7	156	228	384	6	869	3,023	0	130
Total	326	16	156	294	450	11	853	2,387	9	47
<Total Consumption>										
Asni	3,444	5	178	326	503	7	938			
Tahanaout	3,243	21	152	230	382	18	922			
Amizmiz	2,415	32	152	309	462	10	876			
Ait Ourir	3,041	7	156	228	384	6	998			
Total	2,713	25	156	294	450	11	900			

(Note) surveyed by Socio-economic Survey, July 1996.

Expenditure for fuel is estimated as shown in Table 2.3-5, based on fuel prices of DH 0.5/kg for firewood, DH 3.0/kg for charcoal, DH 2.3/liter for butane gas, DH 4.9/liter, and DH 0.5/candle which represent the average among sample households.

Table 2.3-5 Annual Fuel Expenditure per household in the Study Villages

Cercle	Annual Expenditure for Fuel								Free Fuel by Collecting				Total Fuel (DH)
	Wood (DH)	Charcoal (DH)	Butane Gas (DH)			Petrol (DH)	Candle (DH)	Total (DH)	Wood (DH)	Charcoal (DH)	Candle (DH)	Total (DH)	
			lights	fuel	total								
Asni	59	16	408	749	1,158	35	445	1,713	1,663	0	24	1,687	3,400
Tahanaout	73	62	350	530	880	88	442	1,545	1,548	0	19	1,567	3,112
Amizmiz	220	56	351	711	1,062	50	419	1,807	987	40	20	1,047	2,854
Ait Ourir	9	21	359	524	882	30	434	1,376	1,512	0	65	1,576	2,953
Total	163	49	359	677	1,036	52	427	1,727	1,194	26	23	1,243	2,970

(Note) surveyed by Socio-economic Survey, July 1996.

As shown in Table 2.3-5, total annual expenditure for fuels is estimated at DH 1,727 per household. On the other hand, free cost fuels are estimated at DH 1,243 in total, composed of collected firewood and homemade charcoal and candles. Therefore, total value of consumed fuels amounts to DH 2,970, of which 58% is purchased and 42% collected or homemade. Out of purchased fuels, butane gas accounts for 60% or DH 1,036 and candles 25% or DH 427. Candles are exclusively utilized for lighting as is one third of butane gas. Candles and butane gas for lighting amount to DH 786, which is a large portion at 45.5% of total purchase cost (DH 1,727) of fuels.

(4) Electricity Related Analysis

1) Extension of Electric Appliances and Utilization

Table 2.3-6 shows the present extension of electric appliances and utilization and expenditure for the same. Extension rate for radio is more than one per household at 1.2, and 0.57 for TV sets per household or one TV set for two households. Electric lighting extension is very limited at 0.02 per household, or is one electrical light for 50 households, because lighting is commonly provided by candles and butane gas lights. Radio is usually operated with dry cells, and TV sets by car batteries. Car batteries are recharged once in every 17 days on average, and the battery has to be carried to the nearest town at every recharge. Mule or donkey is commonly used for carrying car batteries. In 74% of the cases car batteries are so transported, and in 26% of the cases battery transport is by car. Air conditioner extension rate is very limited at one per 100 households in Asni, Tahanaout and Amizmiz cercles. Electric driven refrigerators are not reported in use at present.

Monthly expenditure for electricity is DH 97 per household on average, and does not show a great difference by area; however a high of over DH 100 is seen in Asni cercle and low of under DH 90 in Ait Ourir cercle. Utilization of radio and TV sets is about 5 hours and 7 hours per day, respectively.

Table 2.3-6 *Extension of Electric Appliances and Utilization per household in the Study Villages*

Cercle	Present Number of Appliances						Expense (DH/month)
	Light	TV	Radio	Air Con.	Refrigerator	Others	
Asni	0.00	0.58	1.10	0.011	0.000	0.04	103
Tahanaout	0.00	0.58	1.09	0.008	0.000	0.01	97
Amizmiz	0.02	0.58	1.24	0.009	0.000	0.10	97
Ait Ourir	0.00	0.40	1.40	0.000	0.000	0.00	87
Total	0.02	0.57	1.21	0.008	0.000	0.07	97
	Duration of Utilization (hrs/day)						
Asni	-	5.42	7.37	10	-	3.5	
Tahanaout	3.00	5.71	7.06	10	-	4.0	
Amizmiz	5.40	4.92	6.51	10	-	2.2	
Ait Ourir	-	5.30	6.72	-	-	-	
Total	5.00	5.12	6.72	10	-	2.34	

(Note) surveyed by Socio-economic Survey, July 1996.

2) Electrification Level Desired by Villagers

The desired electrification level for the Study villages was inquired of both the village leaders and the villagers. As for the village leaders, their opinions on the effective use of electricity and on the appliances to be electrified were obtained; for the villagers, the desired articles and the necessary numbers and hours for

utilization were inquired. Both results are summarized in Table 2.3-7 and in Table 2.3-8, respectively.

Table 2.3-7 Opinion of the Village Leaders for Electrification

	Necessary household appliances							Desired electrification			
	Lighting	Heating	Cooking	Refrigerator	TV + radio	Air conditioner	Others	Lighting only	Lighting + TV + radio	TV + radio (no)	Others
Response rate	100	8	20	59	100	11	56	2	98	2	*

*Unnecessary (45%), video (27%), refrigerator (26%), milling (13%), freezer (10%), air conditioner (4%), water supply (3%)

Table 2.3-8 Electric Appliances and Utilization Hours Desired by the Villagers

Descriptions	Electric Appliances						
	Light	Radio	TV	Heater	Air Cond.	Others	
Households	988	977	934	13	20	302	
Ratio (%)	99.6%	98.5%	94.2%	1.3%	2.0%	30.4%	
Desired Number of Articles	7.6	1.4	1.1	1.1	1	1.3	
Max.	40	8	3	2	1	4	
Hours for use/day	4.5	7.4	6.5	4.7	20.5	20.8	
Max.	16	18	16	8	24	24	
Min.	1	1	1	2	2	1	

The village leaders fully support utility of electricity for lighting, radio and television, but for refrigerator such support is only at 59%. Most village leaders do not want utilization of electricity for heating, cooking and air conditioning, respectively. At the same time, 98 % of them support the electrification formula.

On the other hand, the villagers want electrification for lighting at 99.6%, radio at 98.5% and television at 94.2 %, respectively. Desired number of appliances by villagers are 7.6 lights, 1.4 radios and 1.1 television per household on average. Desired duration of utilization is 4.5 hours for lighting, 7.4 hours for radio, and 6.5 hours for television per day on average.

3) Payable Electrification Expense declared by the Villagers

As shown in Table 2.3-9, average payable expense for electrification is much different according to village leaders and villagers. Village leaders indicate affordability of DH 1,990 for the initial investment and DH 140 for the monthly expense. On the other hand, villagers indicate affordability of DH 1,050 for the initial investment and DH 70 for the monthly expense. The differences are about 200% between leaders and villagers.

Table 2.3-9 Average Payable Expense per household declared by Village Leaders and Villagers

Average Payable Cost	Unit	Village Leaders (1)	Villagers (2)	Ratio (1)/(2)
Initial Investment	(DH/family)	1,990	1,050	190%
Monthly Cost	(DH/family/month)	140	70	200%

(Note) Figures are average values for the 113 Study villages.

(5) Analysis of Drinking Water and Irrigation Water

1) Sources of Drinking Water and Irrigation Water

Table 2.3-10 shows the distribution of sources of drinking water and irrigation water based on the questionnaire to sample households.

As for drinking water, most households depend on springs at 73%, followed by wells at 32%, water tanks at 19%, and rivers at 17%. The reason why the total dependence exceeds 100% is due to several water sources for one household for security.

Regarding irrigation, about half at 49% depends on springs, and followed by rivers for 41%. Dependence on rivers is high at 82% in Asni cercle which indicates that river discharge is stable in Asni cercle.

Table 2.3-10 Water Sources of Drinking and Irrigation Water in the Study Villages

Cercle	Drinking Water				Irrigation Water		
	River	Spring	Well	Tank	River	Spring	Well
Asni	18%	91%	1%	0%	82%	46%	0%
Tahanaout	15%	58%	41%	0%	38%	37%	17%
Amizmiz	16%	72%	38%	28%	31%	52%	9%
Ait Ourir	26%	77%	17%	11%	55%	54%	9%
Total	17%	73%	32%	19%	41%	49%	9%

2) Shortages in Drinking Water and Irrigation Water

Table 2.3-11 shows the satisfaction water sources, and frequency of shortage of each water source for drinking water and irrigation water. Satisfaction determined from the answers of the sample households while frequency is determined from the responses of the village leaders. Satisfaction is high for springs both in terms of drinking and irrigation water. Responses indicate that shortages in drinking water occur every year. On the other hand, shortage of irrigation water for the Study households is estimated to not be so severe in that such shortage occurs overall once in 8 years.

Table 2.3-11 Satisfaction and Frequency of Water Shortage of Water Sources in the Study Villages

Cercle		Drinking Water				Irrigation Water		
		River	Spring	Well	Tank	River	Spring	Well
Asni	Satisfaction	41%	88%	7%		62%	72%	0%
Tahanaout	Satisfaction	18%	85%	61%		35%	71%	32%
Amizmiz	Satisfaction	21%	82%	45%		35%	49%	16%
Ait Ourir	Satisfaction	13%	69%	19%		47%	76%	15%
Total	Satisfaction	23%	82%	42%		39%	57%	16%

(6) Analysis of Natural Condition and Disaster

It is reported that floods occur in 55 villages (48.2% of 114 Study villages), and landslides in 13 villages (11.4%) respectively as shown in Table 2.3-12. This information is important for analyzing accessibility to the villages. Considering the average altitude and range of the whole 114 Study villages at 1,250 m \pm 400 m, both floods and landslides occur in the high mountainous area.

Table 2.3-12 Occurrence of Floods and Landslides in the Study Villages

Occurrence of disasters	Villages concerning	Ratio to 114 villages	Range of Altitude
Floods	55 villages	48.2%	1,431 m \pm 350 m
Landslides	13 villages	11.4%	1,319 m \pm 340 m

(7) Analysis of Environmental Aspect

Over-cutting and over-grazing are some of the causes of deforestation. This fact is recognized by 108 village leaders, or 95% of the 113 Study villages. Table 2.3-13 shows the responses with regards to this recognition. As shown in the table, over-cutting is reported in 14 villages, and over-grazing in 51 villages. These villages are located at lower altitudes and are concentrated in Amizmiz cercle.

Table 2.3-13 Over-cutting and Over-grazing in the Study Villages

Impact Factors	Villages concerning	Ratio to 114 villages	Grade of Impact		Altitude Range
Over-cutting	14 villages	10%	none affection	8 villages	1,210m \pm 270m
			slight	6 villages	
Over-grazing	51 villages	44.7%	none affection	8 villages	1,210m \pm 330m
			slight	37 villages	
			severe	6 villages	

(8) Public and Industrial Facilities

In the study villages, there are following public and industrial facilities.

Public Facilities	Industrial Facilities
Schools, Hospitals, Mosques, Public halls, Cooperatives, Warehouses	Stores, Butcheries, Flour mills, Potters

Schools and mosques exist in most villages, but hospitals are scarce being present in only 5 villages. The hospitals function only for emergency first-aid. The above facilities are described in the appended inventory. The size of schools in 2010 is indicated for reference.

2.4 Supplemental Survey of Previous Decentralized Electrification Projects

In order to reflect the results of decentralized rural electrification carried out to date in other parts of the country, supplemental survey was carried out of the Pilot Rural Electrification Program (PPER) in the following areas:

Province	Description	Survey method
Aziral	PV generation and micro-hydropower	*1) By questionnaire survey
Safi	PV generation	Interview and data collection
Errachidia	Diesel generation	Interview and data collection

*1) The questionnaire survey focused on degree of interest in future electrification, degree of satisfaction with the present situation, desired electrical appliances and power consumption.

The locations of the above PPER projects are indicated in the figure below.



Figure 2.4-1 Sites (PPER) Subject to Supplementary Survey

2.4.1 Case Study of Azilal Rural Electrification Project

(1) Project Scale

The subject project was completed in June 1996 with assistance from France. The project electrifies 5 villages (totaling 195 households and population of 1,473) by PV generation and micro-hydropower.

Table 2.4-1 Beneficiary Villages and Households in the Azilal PPER Project

Project	Total Households		Member Households		Sample Households	
	Households	Population	Households	Rate	Households	Rate
Beneficiary Villages						
Micro-hydrostation	108	810	98	90.7%	10	9.3%
Tirika	48	405	46	95.8%	4	8.3%
Ait Yahia	30	190	27	90.0%	3	10.0%
Ait Oukrim	30	215	25	83.3%	3	10.0%
PV Battery Station	87	663	56	64.4%	8	9.2%
Aghri	42	301	26	61.9%	4	9.5%
Oukta	45	362	30	66.7%	4	8.9%
Total	195	1,473	154	79.0%	18	9.2%

Electric charges of the micro-hydropower system are as follows;

Membership fee:	DH 1,130 (previously 630 DH)
Electricity fee:	DH 5 /kWh
Battery charge:	DH 10 /battery (regardless of size)

<Questionnaire survey>

Results of questionnaire survey for 2 micro-hydropower schemes (10 households) and PV generation area (8 households) are indicated below.

Table 2.4-2 Annual Incomes, Desired Expansion of Electric Articles and Payable Cost by the Sample Households

Project Households No.	Annual Income (DII/yr)	Electric Equipment										Payable Cost for Expansion				
		Present			Additional Requirement				Total Number after Expansion					Investment	Monthly charge	
		Lights	Radio	TV	Lights	Radio	TV	Air conditioner	Refrigerator	Lights	Radio	TV	Air conditioner			Refrigerator
(DII) (DII/month)																
Microhydro Station																
1	25,000	3	2	0	3		1			6	2	1	0	0	100	25
2	16,450	5	1	0	2	1	1	2		7	2	1	2	0	430	26
3	8,000	2	1	0	2					4	1	0	0	0	370	30
4	50,000	3	2	1	4	1	1			7	3	2	0	0	280	68
5	52,500	5	2	1	5	1	1			10	3	2	0	0	380	70
6	28,350	1	1	1	5	1	1			6	2	2	0	0	80	16
7	10,300	2	1	1	3	1				5	2	1	0	0	320	42
8	10,000	5	2	0	4		1		1	9	2	1	0	1	1,500	100
9	15,000	3	0	0	5		1		1	8	0	1	0	1	160	28
10	12,250	2	1	0	2		1			4	1	1	0	0	120	20
Average	22,785	3.1	1.3	0.4	3.5	0.5	0.8	0.2	0.2	6.6	1.8	1.2	0.2	0.2	374	43
PV Battery Station																
1	18,600	1	1	0						1	1	0	0	0	180	7
2	15,000	3	2	0						3	2	0	0	0	0	0
3	35,360	4	0	0			1		1	4	0	1	0	1	432	30
4	8,100	7	1	1	4					11	1	1	0	0	0	0
5	10,000	2	1	0	2	1			1	4	2	0	0	1	150	15
6	8,000	2	1	0			1			2	1	1	0	0	600	60
7	14,550	5	1	0	2	1	1		1	7	2	1	0	1	430	32
8	61,250	5	1	1	2					7	1	1	0	0	0	0
Average	21,358	3.6	1	0.3	1.3	0.3	0.4	0	0.4	4.9	1.3	0.6	0	0.4	224	18

(Note) based on the questionnaire survey by the CDER in August 1996.

(2) Salient Project Features

1) Battery Charge Stations in Aghri, Oukta

The battery charge station (BCS) in Aghri, Oukta (Azilal Province) was constructed under PPER with cooperation from France. It is one out of 7 existing such facilities in Morocco.

Operation commenced in January 1995, targeted at 56 households in 2 villages. The facility site was selected by the villagers themselves at an area of relatively little incline.

Considering charge of extra batteries for cloudy conditions, the capacity of PV modules installed is about 2 fold that necessary for a clear day. Tilt angle of the PV array is 35° to enable maximum output in the winter season. Construction cost of the battery charging station including batteries was DII 33 million.

Table 2.4-3 Design Features of the Battery Charge Station

Equipment	Module type (BP×47 500)	Parallel no. of modules	No. of charging ports
30 Ah battery	48 W poly-si	2 (6 amp)	3
75 Ah battery	50 W poly-si	5 (15 amp)	11
Portable lamp	9W amorphous-si	1	20

note:

- 1) Average no. of batteries charged per day: 5-8
- 2) Recharging time in winter season: 1.5 days
- 3) Average recharge interval: 2 weeks
- 4) Equipment under the project:
 - 78 Ah battery × 66
 - 30 Ah battery × 48
 - Portable lantern × 30
 - Street light × 7
 - SHS (PV kit) w/ TV × 4

Table 2.4-4 Load Level Classification in Each Household

Level	No. of lamps	TV (black & white)	Battery size	Households w/ TV (%)
1	8 W × 1	no	30 Ah	19 (13.0)
2	8 W × 2	no	30 Ah	40 (35.0)
3	13 W × 1 + 8 W × 1	1	75 Ah	27 (22.4)
4	13 W × 2 + 8 W × 2	no	75 Ah	48 (26.0)
5	13 W × 3 + 8 W × 5	1		0 (3.6)

note:

- 1) () indicate average for Azilal Province
- 2) Micro-hydropower Facilities (Tirika, Ait Yahia, Oukrim)

(a) Design Criteria

a) Base criteria

- Equipment: Priority on locally produced equipment given the status of such equipment produced in Morocco. Equipment is the simple outdoor type, with easy O&M.
- Surface treatment: Rust proofing treatment of all metal surfaces

b) Specific criteria

Canal:	Installation of screen, manually removable trash rack and water drain gate for canal inspection and repair
Penstock:	450 mm dia. steel pipe
Inlet gate:	For turbine startup and shutdown
Draft tube:	Fixed with metal fasteners
Electrical panel:	Outdoor naturally ventilated type equipped with circuit breaker, frequency meter, power meter, and voltmeter
Protection:	Lightning rod and earthing works

c) Peripheral criteria

Temperature:	Max. 50°C, min. -15°C, ave. 20°C
Humidity:	90%

(b) Salient Features

Type of generation:	Utilization of existing irrigation canal.
Irrigation canal:	800 mm width × 500 mm depth × 1 km length
Headrace:	100 m length
Penstock:	450 mm dia. (inner) × 20 m long steel pipe
Turbine:	Type inclined axis, inclined flow, manually movable wing type (THEE of French make)
	Head 4.9 m (max. 5.5 m)
	Discharge 0.18 m ³ /s (max. 0.215 m ³ /s)
	Output 4.7 kW (max. 6 kW)
	Speed 1,180 rpm
Accelerator:	Type belt drive
Generator:	Type outdoor, 3 phase synchronous
	Output 12 kVA
	Voltage 400 V
	Frequency 50 Hz
	Speed 1,500 rpm
Control:	Dummy load system
Electrical panel:	Type outdoor, naturally ventilated type
	Instruments voltmeter, frequency meter, power meter
	Switching circuit breaker
Distribution wiring:	3 phase, 4 wire 400 V / 230 V
No. of households:	98 households (3 villages)

(c) Appurtenant Facilities

- a) Milling machine: 1 nos. (motor output: 5.5 ps)
- b) Large scale battery charger 1 set
- c) Portable lantern recharger 1 set

(3) Project Operation and Maintenance

1) PV Battery Charging Station

The total of 84 batteries are not owned individually by the 56 subscriber households, but rather rotate from one household to another in order that subscribers need not wait for batteries to be recharged.

To protect batteries from over discharge, over discharge protectors are installed in each household. The protectors cut off current supply at discharge rate of 30%.

According to the operator's report, typical recharging interval is 2 weeks. Since this interval appears to be excessively long given the load level at each household, it is probably due to the fact that subscribers keep a flat battery at the house even due to inability to pay the recharge fee. (This is a cause of degeneration in battery life.)

A special association has been created for PV electrification consisting of 7 persons including a president, vice president, financial manager, vice secretary and group leaders. Association members are elected under law by the villagers.

Daily maintenance is the responsibility of a field operator trained by CDER. As the equipment has no moving parts, maintenance works consist mainly of wiping the PV panels, topping of batteries with water, and cleaning. All equipment belongs to the project, and is under the management of the special association with the supervision of CDER.

- Charge rate:
 - 75 Ah battery : DH 10
 - 35 Ah battery : DH 5
 - Portable lantern : DH 4

- Other charges for subscribers:
 - Facility charge : DH 6/mo./light for 6 months
 - Portable lantern rental guarantee : DH 4 (used when moving about outside at night, etc.)

2) Micro-hydropower Facilities

(a) Association of Beneficiaries

Creation of an Association of Beneficiaries was obligatory under project implementation, to assume responsible for operation of facilities.

Organization and decree of association are as follows.

<Organization>

- 1 president
- 1 vice president
- 1 general secretary
- 1 vice general secretary
- 1 treasurer
- 1 vice treasurer
- 5 counselors

<Decree of Association>

Decree of association comprises 40 articles ("Article 1: Foundation of the association" ~ "Article 40: Accounting")

(b) Electricity Consumption

Initially indicated monthly cost for the designated equipment is as indicated below; however, at present membership fee is DH 1,130 and electricity tariff is DH 5 / kWh.

Item	Wattage	Fixed cost (DH/month)	Surcharge (DH/month)*	Total (DH/month)
TV	15 W	6	34	40
Lighting	1 × 8 W	12	10	22
Lighting	2 × 8 W (16 W)	20	20	40
Lighting	2 × 8 W + 1 × 13 W (29 W)	35	35	70
Lighting	3 × 8 W + 2 × 13 W (50 W)	55	55	110

*note: Power consumption for 8 hours per day is roughly DH 5/kWh

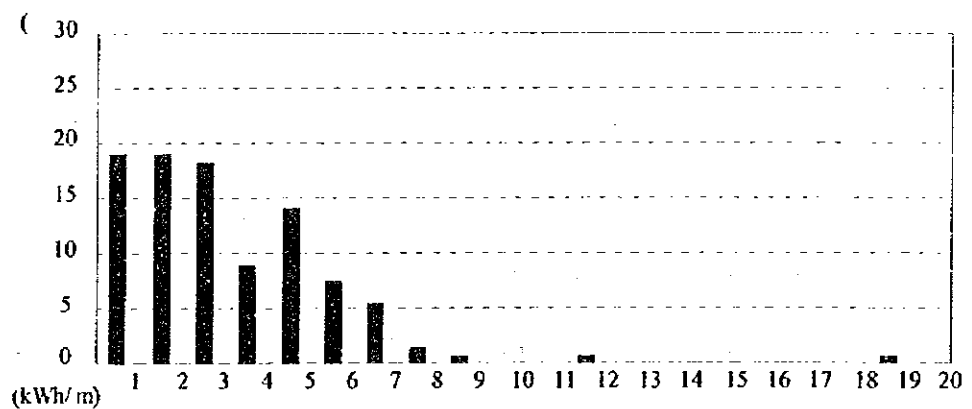
Electricity consumption per household from November 1995 to February 1996 is as follows:

Monthly electricity consumption (kWh)	No. of households	% of total households
0~3	53	56
3~7	36	38
7~19	6	6
Total	95	100

Electricity consumption amount-wise breakdown is shown in Figure 2.4-3. Monthly mean consumption per household is 3.51 kWh, which is a consumption of 30 W over a 4 hour period each day.

As indicated in Figure 2.4-2, households can be divided into low consumers of up to 3 kWh per month (approx. 56% of total households), medium consumers of 3 kWh ~ 7 kWh per month (approx. 38% of total households), and high consumers of over 7 kWh per month (approx. 6% of total households).

Figure 2.4-2 Distribution of Month-wise Electricity Consumption



(4) Project Impact

Beneficiaries under the project evaluate the impact of the micro-hydropower and PV battery charging stations as follows:

- Children are able to continue school studies at night
- Adults are able to continue working at night
- TV viewing hours per day have increased

Degree of satisfaction with project impact depending on the project component is as follows:

	Greatly satisfied	Moderately satisfied	Dissatisfied
Micro-hydro	60%	40%	0%
Solar generation	25%	37.5%	37.5%

Note: In contrast to the case of micro-hydro where as long as the facility is in operation the contract maximum load is available to each household, in the case of PV generation the need for battery recharging places a limitation on available energy. Also, there is the inconvenience of having to transport the PV battery to the nearest recharging station.

(5) Current Problems

1) Battery Charging Station under PV Generation

The supplemental survey indicated the following problem issues.

As indicated by the average consumer:

- Battery life is too short
- There is no way to tell to what degree the battery has been recharged
- Sufficient O&M support is not available
- There is a wide disparity in the quality of fluorescent light tubes, with some lasting up to 1 year, while other fail after only 1 month.
- In addition to problems with battery life, excessive discharge rate results in batteries being unusable.
- Amorphous PV panels experience a drop in output after 1 year of use.

2) Micro-hydropower Facilities

The supplemental questionnaire survey indicated the following problem issues.

- Generating capacity is not sufficient to meet power demand growth
- Generation shuts down during storms
- Certain beneficiaries do not pay their monthly electricity tariffs
- Two blackouts occur weekly
- Milling machines are not used very much

2.4.2 Study of Safi Province and Errachidia Province

(1) PV Generation in Safi Province

1) Project Description

Method of electrification is by PV battery charge station (BCS), as well as individual home installed (SHS). The location of the BCS facility is 20 km from Safi city center.

No. of targeted villages	:	10
No. of electrification associations	:	10
No. of targeted households	:	544
No. of subscribers serviced	:	339 (62%)
No. of subscribers on waiting list	:	119 (22%)
No. of facility expansions	:	189 (56%)
Total no. of subscribers including waiting list	:	458 (85%)

2) Facility Description

BCS size comprises 1.8 kW crystal module and 63 W amorphous (9 W × 7 panels) for lantern recharge. Design criteria are the same as that for Azilal Province.

Numbers of subscriber by electrification level classification is as shown in Table 2.4-5. Number for level 2 (8 W fluorescent light × 2) is largest at 41%, followed by level 1 (8 W fluorescent light × 1) at 28%, and lastly by levels 3 (8 W fluorescent light × 2 + 13 W light × 1 = 3 lights) and 4 (8 W fluorescent light × 3 + 13 W light × 2 = 5 lights). Owners of TVs for each level have not yet been precisely identified; however, total such ownership is estimated at around 70%.

Table 2.4-5 Electrification Level Classification

Level	1	2	3	4	TV	Total
Subscribers	97	155	67	20	(121)	339
BCS users (%)	28%	41%	15%	2%	(85)	86%
SHS users (%)	0%	5%	5%	4%	(36)	14%

3) Recharge Fee Structure

<u>Battery type</u>	<u>Fee</u>
75 Ah:	DH 9 (impoverished households) DH 10 (standard household)
30 Ah:	DH 5
Portable lantern:	DH 3

- Average monthly charge fee received per unit group is DH 777 (there are 10 groups in the project area)
- Expenditure for electricity fees per household is DH 30/month, comprising DH 10/month repayment for kit equipment including house wiring and fluorescent light, and DH 20/month for recharge fee.

- Repayment rate for house wired kits is currently 97%. Recharging frequency and status of electricity use in each household are shown in Table 2.4-6.

Table 2.4-6 Recharge Frequency and Status of Electricity Use in Each Household

Equipment	Recharge interval (days)	Wh/day/ household	hour/day/ household
30 Ah battery	18	19	1.9
75 Ah battery	17	50	4.2
Portable lantern	19	4	0.7

Electrification forecast based on aspiration of area residents and subscriber waiting list is indicated in Table 2.4-7. However, this does not include the 19 villages targeted under phase 2.

Table 2.4-7 Electrification Forecast

Level	1	2	3	4	TV	Total
Subscribers	47	225	158	28	(283)	458
BCS users (%)	11%	10%	2%	1%	(73)	24%
SHS users (%)	0%	40%	32%	5%	(210)	76%

4) Project Evaluation

The project area is located near an urban center, and as a result many households had been utilizing batteries prior to construction of the BCS by making the journey to Safi city for recharge.

Battery recharge agents confirmed the status of charge simply by shorting the battery and observing if sparking occurred, a practice which shortens battery life (to an average 6 months). Although villagers welcome the BCS system, many exhibit desire to switch in the future to the individual household PV systems (SHS) which are already in use to a certain extent in the area, an issue which will require further study in the future.

5) Current Problems

- When voltage drops below 8 V, batteries cannot be recharged. As even 12 V batteries fall drop below 8V, there is room for improvement.

- Communal rotation of batteries among households has not been successful in the area, and instead households utilize individually owned batteries. The reason for this is a feeling among subscribers of unfairness in the case of delinquent customers who allow flat batteries to remain unused in their homes, resulting in battery voltage drop. Proximity of villages to urban area also is a factor in reduced sense of community solidarity and a more independent and entrepreneurial spirit among area residents.
- There is a disparity in utility life of fluorescent light bulbs depending on the manufacturer.

(2) Diesel Power Generation in Errachidia Province

1) Project Description

Under the PPER project, the villages of Tigra-Ait Ouakki (Assoul C.R.), Lahroun (Amellago C.R.), and Mcissi (Mcissi C.R.) in Errachidia province have been selected as experimental villages for the introduction of diesel generating facilities. Errachidia province is representative of the Atlas range southern slope ~ sub-Saharan zone and is characterized by low rainfall. Features of the subject villages are given in Table 2.4-8.

Table 2.4-8 Features of Villages under the Diesel Generating Plan

Village name	Tigra-Ait Ouakki	Lahroun	Mcissi
Province	Errachida	Errachida	Errachida
Circle	Assoul	Assoul	Arfoud
C.R.	Assoul	Amellago	Mcissi
Location:			
X	522	542	511
Y	157.5	153	70
Elevation (m)	1,500	1,280	825
No. of households	130	82	102
Member households	112	70	90
Public electrical facilities			
Mosques	3 × lighting kit 2 × amplifier	1 × lighting kit 1 × amplifier	1 × lighting kit 1 × amplifier
Street lighting	13	7	9
Schools	1 × lighting kit	1 × lighting kit	2 × lighting kit
Households by load rate:			
1 × 8 W lighting	8 (2)	11 (2)	1 (0)
1 × 8 W lighting	39 (18)	41 (21)	13 (0)
2 × 8 W + 1 × 13 W lighting	49 (33)	16 (12)	17 (0)
3 × 8 W + 2 × 13 W lighting	16 (14)	2 (1)	31 (0)
Others	0 (0)	0 (0)	14 (14)
Total	112 (67) → [90]	70 (36) → [45]	90 [14]

note: () indicate households with TVs prior to start of service
[] indicate households with TVs after start of service

2) Facility Description

Diesel generating equipment and distribution line installed in each village are as indicated in Table 2.4-9.

Table 2.4-9 Diesel Generating Equipment and Distribution Line

Village name	Tirga-Ait Ouakki	Lahroun	Mcissi
Diesel generating equipment			
Diesel output:	22.5 ps	15 ps	34 ps
Rpms	1,500 rpm	1,500 rpm	1,500 rpm
Fuel cost:			
100% load	0.375 ℓ / kWh	0.375 ℓ / kWh	0.413 ℓ / kWh
75% load	0.40 ℓ / kWh	0.40 ℓ / kWh	0.45 ℓ / kWh
50% load	0.45 ℓ / kWh	0.45 ℓ / kWh	0.525 ℓ / kWh
25% load	0.60 ℓ / kWh	0.60 ℓ / kWh	0.75 ℓ / kWh
Generator:			
Capacity	15 kVA (12 kW)	10 kVA (8 kW)	20 kVA (16 kW)
Voltage	400 V	400 V	400 V
Power factor	0.8	0.8	0.8
Distribution line:			
Cable	4,201 m	2,546 m	2,759 m
Pole	111 nos.	81 nos.	107 nos.

3) Actual Load at Tirga-Ait Ouakki

Actual load curves for the summer and winter are indicated in Figure 2.4-3 and Figure 2.4-5. Phase-wise load curves for each of the foregoing are further indicated in Figure 2.4-4 and Figure 2.4-6.

In the summer time, load is greatest during the time period 19:40 ~ 23:30, while during the winter time the same is for the period 18:30 ~ 21:00.

A considerable difference is seen for each phase load; however, this is considered due to insufficient examination of the initial load allocation for 4 phase, 3 wire type distribution.

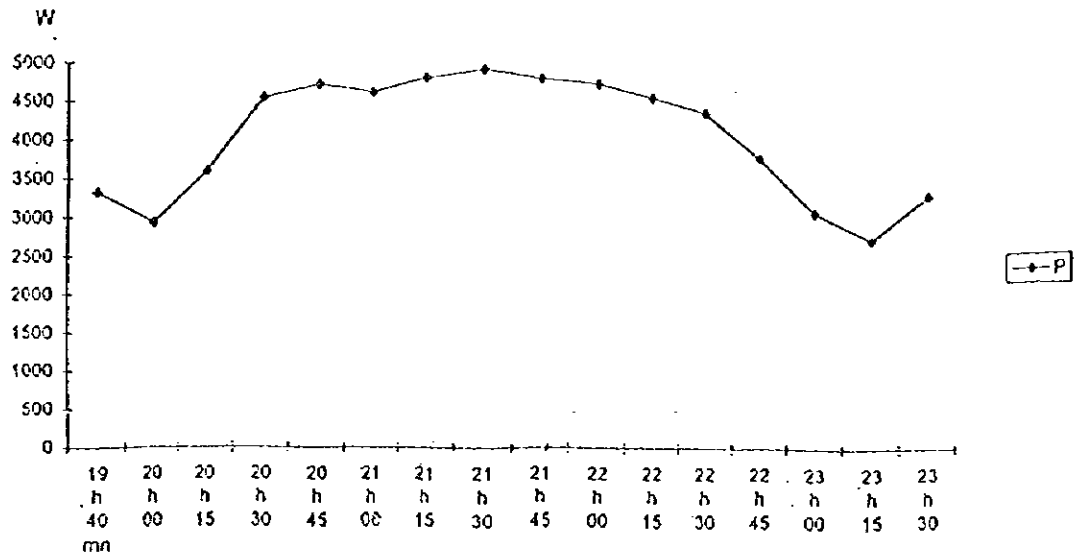


Figure 2.4-3 Summer Load Curve (overall)

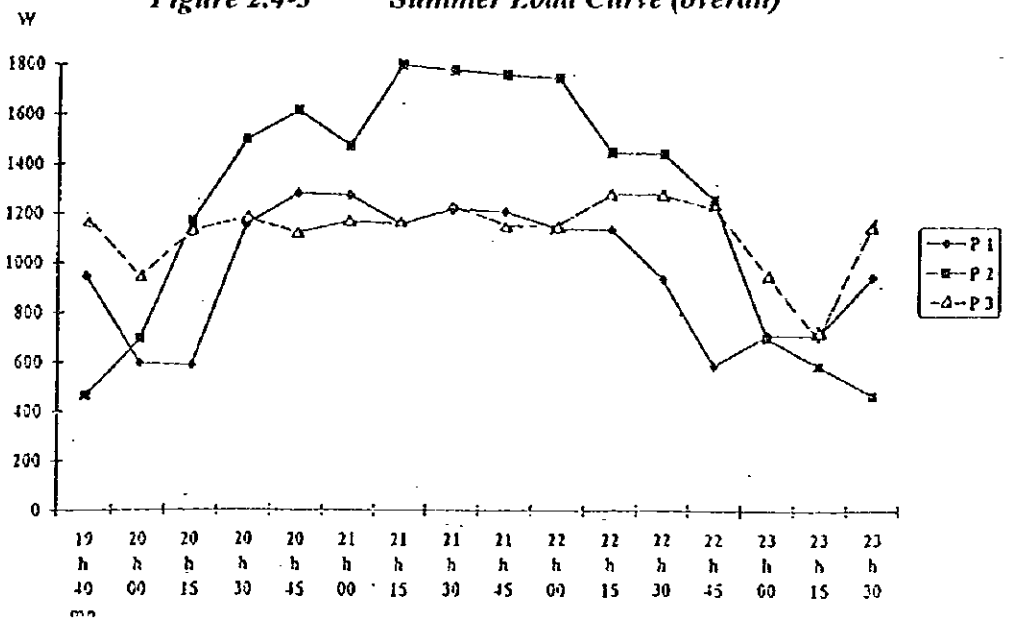


Figure 2.4-4 Summer Load Curve (phase-wise)

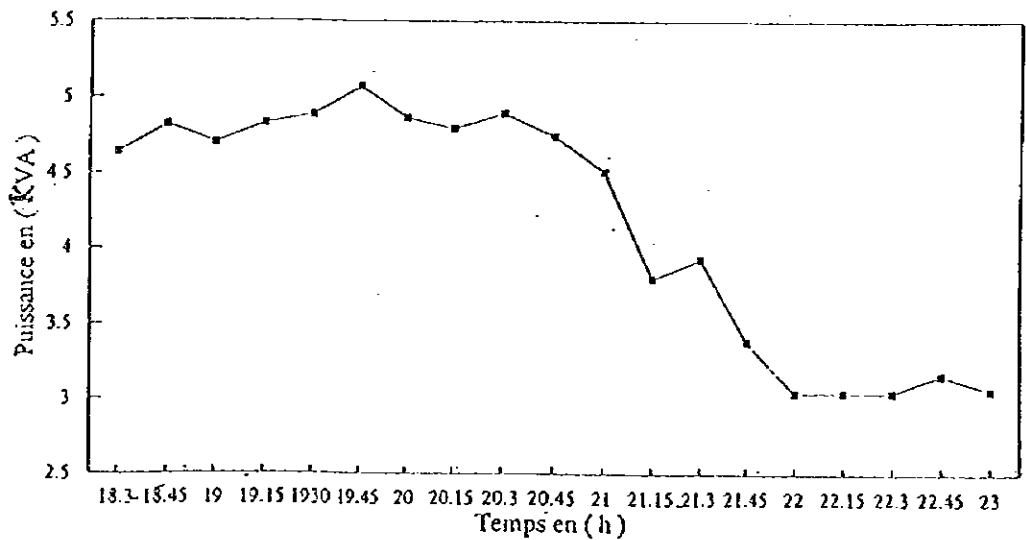


Figure 2.4-5 Winter Load Curve (overall)

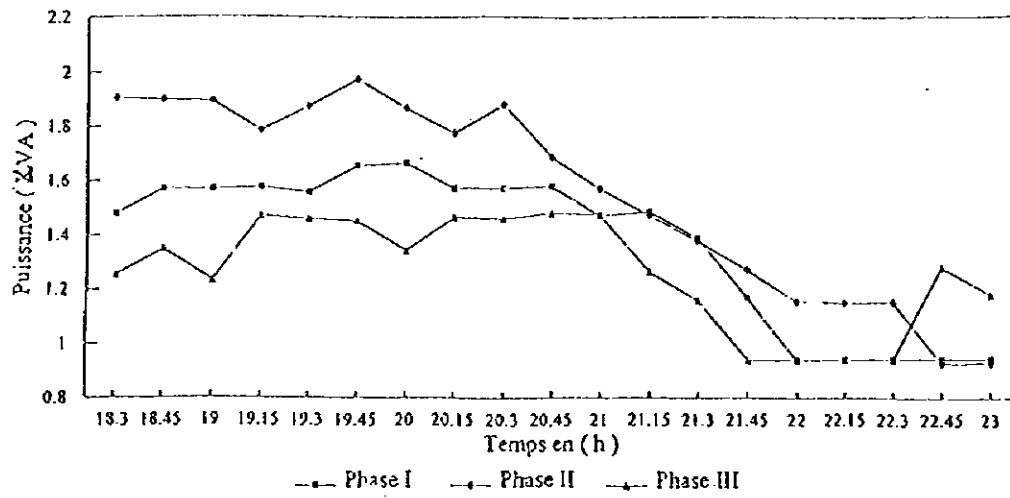


Figure 2.4-6 Winter Load Curve (phase-wise)