CHAPTER IV

FINDINGS AND DISCUSSION

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Findings of the investigation as obtained on the analysis of data collected through interview cum observation schedule are described and discussed in this chapter. Personal characteristics of main cooks and their demographic characteristics are presented first.

Level of quality of housing, extent of possession of consumer durable goods, extent of demands on main cook's time, energy base of end uses, extension of activities of family after dusk, energy management practices of family, extent of interaction of main cook and family with different spheres are also discussed.

Energy consumption pattern, perception regarding available and accessible cooking fuel sources, participation in cooking fuel cycle, practices related to family cooking, and responses related to traditional cookstoves are summarised next.

Motivational factors for opting for MC, location of MC, changes made in MC, details on installation, use, care and maintenance of MC, and overall satisfaction/dissatisfaction with reference to MC along with contributing factors for the same are then described. Level of quality of installation of MC, main cook's and families' extent of participation in National Programme on Improved Chulha (NPIC), their extent of adoption of MC as a cookstove and perceived cost benefit ratio are summarised

next. Then profile of beneficiary families in general and extreme adoption scorers are presented. Profile of those with high and low perceived cost-benefit ratio (PCBR) are also described. Lastly hypotheses are tested and discussed.

1.0 Description of the sample

Insight into the baseline characteristics of the sample was sought through personal interviews. The personal characteristics of main cooks and demographic characteristics of beneficiary families are summarised in the ensuing paragraphs highlighting the major observations first for the total sample and then by village.

1.1 Age of the Main Cook

The range in the age of main cooks was 18 to 90 years. A little over one-third of them were 25 to 34 years in age with about one-fourth each of the rest of them being in age groups of 35 to 44 and 45 to 54 years respectively. Negligible proportion of main cooks were either <25 years or >54 years in age. Their mean age was 35.75 years. This implies that by and large they were exposed to cooking at TRCs for a fairly long period.

A little over one-third of them from each of the villages under investigation belonged to the age group of 25 to 34 years. A little less than one-third of them were between 35 to 44 years old in Vadadla and Sindhrot. On the other hand, a greater proportion of main cooks in Kanjari were aged between 45 to 54

years as compared to the other two villages. While more or less the same percentage - one-third - of them belonged to either of the two age groups, viz., 25 to 34 years and 35 to 44 years in Vadadla and Sindhrot, the same was true in case of those in the age groups of 25 to 34 and 45 to 54 years in Kanjari. The pattern of their distribution by their age was comparable in Vadadla and Sindhrot. The mean age of cooks in Kanjari was slightly higher (37.19) as compared to that of the other two villages-Vadadla and Sindhrot-where mean age was 35.07 and 34.98 respectively (Appendix IV : Table 1).

Table 1: Distribution of Families by Age of the Main Cook

Age in Years	N	%
<25	30	7.69
25-34	151	38.72
35-44	114	29.23
45-54	90	23.08
> 54	5	1.28
Total	390	100.00
Mean	35.75	
SD	9.42	

1.2 Education of Main Cooks

The main cooks were women in 99.23 per cent of the families studied. The statistics on literacy level of Indian women, especially, rural women in Gujarat reveals that only 32.78 per cent are literates (Census Survey of India, 1991).

Table 2: Distribution of Families by Education of the Main Cook

Education level	N	%
Illiterate	326	83.59
< SSLC	57	14.61
SSLC & above	7	1.79
Total	390	100.00

The views and approaches to innovations are likely to be moulded by the formal education level of an individual. The findings of the present study revealed that only a little less than one-fifth of the main cooks had undergone formal education and 84 per cent of them were illiterates. Further analysis showed that about 15 per cent of educated cooks had completed upto 9th class while a negligible proportion, i.e., 2 per cent had studied beyond SSC level (Table 2). Further scrutiny of data on education level of main cooks revealed that majority of those with formal education were young in age (< 34 years). Main cooks in Vadadla revealed the highest proportion, i.e.,- one-fourth - with formal education followed by those in Sindhrot (Appendix IV : Table 2).

1.3 Family Caste

Majority of the beneficiary families were from general category while nearly one-seventh of them belonged to SC/ST category (Table 3). Further scrutiny revealed that while about one-third of the beneficiaries from Kanjari belonged to SC/ST

category, only negligible proportion of them in the other two villages were from SC/ST category (Appendix IV : Table 3).

Table 3: Distribution of Families by Caste

Caste	N	%
General category	329	84.36
SC/ST	61	15.64
Total	390	100.00

1.4 Family Size

The number of persons living in a family ranged from one to thirteen. The distribution of families by total number of persons sharing common roof, kitchen and purse revealed a clustering of more families around 4 to 6 members with their proportions tapering towards either ends, i.e., with less and more number of members than 4 to 6 (Table 4). Approximately 6 per cent of the families comprised of 9 or more and 3 members each. The village wise data on family size revealed more or less the same picture (Appendix IV : Table 4). The mean family size for the entire sample was 5.47 with mean values of 5.31, 5.84 and 5.26 for those in Kanjari, Vadadla and Sindhrot respectively.

Further analysis of data on family members showed that nearly half of them had at least 2 adults, the same being true in all the villages covered (Appendix IV : Table 5). More or less a comparable proportion of families (24 per cent) had 2 or 3

children who were under 18 years of age. The mean number of adults and children in the families studied were 3.00 and 2.24 respectively (Table 4) with not much variation in the corresponding values for each of the villages (Appendix IV : Table 5).

Table 4: Distribution of Families by Number of Adults, Children and Total Members

Number	Adults		Children		Total members	
	N	%	N	%	N	%
0	-	-	68	17.43	-	-
1	17	4.36	57	14.65	5	1.28
2	194	49.74	95	24.36	22	5.64
3	61	15.64	95	24.36	23	5.90
4	53	13.59	47	12.05	84	21.54
5	34	8.72	18	4.61	103	26.41
6	20	5.13	7	1.79	63	16.15
7	7	1.79	2	0.51	43	11.02
8	4	1.02	1	0.26	19	4.87
9 & above	-	-	-	-	28	7.18
Total	390	100.00	390	100.00	390	100.00
Mean	3.00		2.24		5.47	
SD	1.49		1.56		3.42	

Further scrutiny of the data showed that sixty nine per cent of the families were nuclear/unitary families which included only (parents and their offsprings . Twenty eight per cent of them

were joint families where more than one unitary family belonging to different generations and /or same generation lived together sharing a common roof, common kitchen and table. A small proportion of beneficiary families belonged to extended families where married children/brothers/sisters come often and stay, may be for short or long periods (Appendix IV : Table 6).

1.5 Landholding

The landholding in the possession of beneficiary families ranged from 1 to 19 hectares with a little over half of the total families being landless. Nearly one-fourth of the families were marginal farmers, who had less than one hectare land under their control. Approximately 9 per cent belonged to the category of small farmers, whose landholding ranged from 1 to 2 hectares. A very small proportion of families had 3 to 4 or more hectares of landholding (Table 5). However in Kanjari nearly 67 per cent of families were landless while in Vadadla corresponding value was 42 per cent. Sindhrot ranked the lowest in the proportion of large farm families while Kanjari ranked the highest in the same amongst the beneficiary families of the present study (Appendix IV : Table 7).

Out of 46 per cent families who had some farmland under their control, 97 per cent had land with only ownership title while a nominal proportion (one per cent) had land with only tenancy right. A negligible proportion (2 per cent) however had land with both ownership title and tenancy right under their control (Appendix IV : Table 8).

Table 5: Distribution of Families by Landholding

Number of hectares	N	%
None	211	54.10
< 1	103	26.41
1-2	35	8.97
3-4	26	6.67
5-6	8	2.05
7 & above	7	1.79
Total	390	100.00
Mean	6.97	
SD	9.74	

Mean for relevant cases.

Nearly one-fourth families cultivated rice followed by bajra -pearl millet- (22 per cent) as the second major crop. More or less an equal proportion of farm families cultivated cumin (jeera) and red gram (tuwar). Cumin (jeera) seemed to be cultivated only in Kanjari and red gram (tuwar) in Vadadla (Appendix IV : Table 9). The other crops raised were wheat and onion.

2. Level of Quality of Housing (LQH)

Level of quality of housing of beneficiary families was assessed in terms of type of housing, nature of materials used, source of drinking water, and sanitary services.

2.1 Type of Housing

Housing condition in rural areas is, by and large, very poor and substandard. The villages which formed the locations of the present investigation were backward villages where various development programmes are yet to reach. Most of the beneficiary families studied were rated as `average' or `poor' with reference to their overall economic positions (Appendix IV : Table 10).

Data on structure of housing of beneficiary families in terms of its type, viz., detached house,twin block and row houses were scrutinised. More or less an equal proportion of families occupied twin block or detached houses. Nearly one-fourth of the families lived in row houses (Table 6). Villagewise analysis revealed that the percentage of families in twinblock was higher in Vadadla (56 per cent) and the proportion of families in detached houses was higher in Sindhrot (41 per cent) as compared to the other two villages respectively. On the other hand, the proportion of families in row houses was lower in Vadadla (Appendix IV : Table 11).

Table 6: Distribution of Families by Type of Housing

Type of housing	N	%
Twinblock	148	37.95
Detached units	134	34.36
Row units	108	27.69
Total	390	100.00

Further analysis of data on row houses revealed that the number of housing units in each row ranged from 3 to 8. Nearly one-third of the families lived in row housing which had 4 units in each. More or less an equal proportion of families had their housing in rows with 3 or 5 housing units in each. Six or eight houses in each row were found to be in a very few cases (Appendix IV : Table 12).

2.2 Nature of Housing Materials

It was observed that the majority (95 per cent) of the families had semipucca houses comprising of a combination of permanent and temporary materials used in construction of walls, floors and/or roofs. Negligible proportion of the total families, i.e., 2 to 3 per cent, lived in pucca or kutcha housing respectively (Table 7). A housing unit was considered `a pucca structure' if all components had permanent materials and `a kutcha structure' if all components were made of temporary materials.

Table 7: Distribution of Families by Nature of Housing Materials

Nature of Materials	Walls		Floor		Roof		Entire house	
	N	%	N	%	N	%	N	%
Kutcha	103	26.41	321	82.31	6	1.54	8	2.05
Semi pucca	14	3.59	31	7.95	167	42.82	371	95.13
Pucca	273	70.00	38	9.74	207	55.64	10	2.82
Total	390	100.00	390	100.00	390	100.00	390	100.00

A probe into nature of materials used in each main structural component of housing like wall, floor and roof, was carried out. Pucca walls were found in 70 per cent of the housing units while pucca flooring was observed in only 10 per cent of the families housing. In other words, kutcha floor was the most common feature, the same being observed in 82 per cent families. Nearly 56 per cent of the housing had pucca roofs (Table 7). Villagewise distribution showed that the majority of the families (55 per cent) in Sindhrot had houses with kutcha walls. In Kanjari nearly cent per cent had houses with pucca roof, and in Vadadla, 80 per cent families had houses with semipucca roof. More or less an equal proportion in Sindhrot had housing with either semipucca or pucca roof (Appendix IV : Table 13).

2.3 Source of Drinking Water and Other Public Utilities

It was found that either community well or natural water sources like pond or river were the only sources of potable water for 41 per cent of beneficiary families (Table 8). The dependence on these sources was quite high mainly in Kanjari (98 per cent). One-third of the total families were fetching potable water from community piped water system, the same being the most common source in Vadadla (90 per cent) followed by Sindhrot village (75 per cent). Both well and community piped water system formed sources of potable water to one-fifth of the families with the incidence of this being the highest in Sindhrot. River and/or domestic piped water system, were also found to be the sources of

water resource in a small percentage of families that belonged to Sindhrot (Appendix IV : Table 14).

Table 8: Distribution of Families by Source of Drinking Water

Source	N	%
Well/pond/river	161	41.28
Community pipe	130	33.33
Well/comm. pipe	86	22.05
River/domestic pipe	8	2.05
Domestic pipe	5	1.28
Total	390	100.00

2.4 Sanitary Services

Sanitary service areas like, bathroom and toilet were also studied. Majority of the families (51 per cent) had an enclosed area of some sort in yard for bathing purpose. Separate pucca bathroom was found in only a small proportion (12 per cent) of families (Table 9). Temporary enclosed area was the most common in Kanjari. On the other hand, kitchen corner and/or open area was the most commonly used area for bathing in Sindhrot (Appendix IV : Table 15).

Majority of the beneficiary families (95 per cent) resorted to open defaecation as they did not have any toilet facility at their disposal. However, a negligible proportion (5 per cent) had a separate toilet - a water closet with manual flushing in their houses (Table 9).

Table 9: Distribution of Families by Sanitary Services

Sanitary services	N	%
Bathroom		
Temporary enclosed area	199	51.02
Independent permanent	45	11.54
Open area	126	32.31
Kitchen corner	20	5.39
Total	390	100.00
Toilet		
None	371	95.13
Flush system	19	4.87
Total	390	100.00

2.5 Overall Quality of Housing

The five aspects related to housing of beneficiary families were quantified by ascribing scores to each as described in chapter on Methodology to arrive at level of quality of housing (LQH) score. The findings revealed that nearly two-third of the sample studied were moderate scorers while 20 per cent were high scorers and the rest low scorers. The mean LQH score for the total sample was 11 with an SD of 1.96 (Table 10). Villagewise analysis showed that the proportion of families with 13 to 15 LQH score was more than that of those with 5 to 8 score in Kanjari and Vadadla while the proportion of low scorers (5 to 8 scores) was more than that of high scorers (13 to 15) in Sindhrot. While

64 per cent each from Kanjari and Sindhrot earned 9 to 12 scores on LQH, the corresponding figure for Vadadla was only 53 per cent (Appendix IV : Table 16).

Table 10: Distribution of Families by Level of Quality of Housing

LQH	N	%
Low	72	18.46
Moderate	238	61.03
High	80	20.51
Total	390	100.00
Mean	11.00	
SD	1.96	

3.0 Extent of Possession of Consumer Durable Goods (EPCDG)

The consumer durable goods in the possession and use of families covered under the present investigation were ascertained and scored. The higher the EPCDG score, the greater the number and the better the quality of consumer durable goods and the higher the level of living. The EPCDG scores of the sample ranged from 10 to 105. On the basis of EPCDG score majority were categorised in the moderate group. More or less the same proportion of families exhibited high and low EPCDG level (Table 11). The families revealed a mean EPCDG score of 42.00. About 40 per cent earned scores ranging from 26 to 41. A decline in proportion of families earning high scores (more than 41 score) was observed as the scores increased (Appendix IV : Table 17).

Table 11: Distribution of Families by EPCDG

EPCDG	N	%
Low	54	13.85
Moderate	278	71.28
High	58	14.87
Total	390	100.00
Mean	42.04	
SD	18.96	

4.0 Extent of Demands on Main Cook's Time (EDMCT)

Data on help received by the main cook-respondent- on various household chores were gathered to gain insight into the extent of demand on her time. A three point continuum was used to assess the extent of help received in terms of `more help', `some help', or `no help'. The data were quantified by assigning scores of 1,2 and 3 to these response categories respectively. The data were interpreted such that the higher the score the greater the demand on the main cook's time due to household chores.

The mean score on EDMCT was 36.95 with an SD of 13.87. More or less an equal proportion of families had cooks with either of the extreme levels of EDMCT. Majority seemed to belong to moderate category (Table 12). Nearly one-third of the families earned an EDMCT score ranging from 21 to 30 and 41 to 50. The findings were more or less comparable in all the three villages (Appendix IV : Table 18).

The lowest mean was observed in Kanjari and the highest in Sindhrot. In other words, the demand on time of main cook in Sindhrot was more as compared to that of Kanjari.

Table 12: Distribution of Families by EDMCT

EDMCT	N	%
Low	92	23.59
Moderate	199	51.03
High	99	25.38
Total	390	100.00
Mean	36.95	
SD	13.87	

5.0 Energy Base of End Uses (EBEU)

Fuels used for lighting, transportation, agriculture and cooking reflected the energy base of end uses. The data were quantified by ascribing scores as explained in chapter on Methodology and was interpreted such that the higher the score the greater the dependence on conventional energy base of end uses. The possible range in scores was 4 to 12. The analysis of data in relation to this, showed that majority were categorised as moderate scorers on EBEU. One-sixth of the families belonged to the category of high scorers while one-tenth belonged to that of low scorers (Table 13). The families earned a mean EBEU score of 7.91. About 44 per cent families had scores that ranged from

Table 13: Distribution of Families by EBEU

EBEU	N	%
Low	41	10.51
Moderate	286	73.33
High	63	16.15
Total	390	99.99
Mean	7.91	
SD	1.30	

six to seven while 55 per cent earned more than seven. Villagewise analysis revealed families of Kanjari relatively less dependent on conventional fuels in comparison to those from Vadadla and Sindhrot for various end uses studied (Appendix IV : Table 19).

6.0 Extension of Activities of Family After Dusk (EAFAD)

The possible range of scores on EAFAD was 8 to 24. The mean score was found to be 14.73. A little over one-third of the families studied had 13 to 14 and 15 to 16 scores each while one-fourth of the families had seventeen or more scores (Appendix IV : Table 20). More or less an equal proportion of families belonged to low and moderate categories each (Table 14). The relative low mean score and the majority earning 16 or less EAFAD score implied that relatively a smaller proportion of families extended activities after dusk to a greater extent.

Table 14: Distribution of Families by EAFAD

EAFAD	N	%
Low	150	38.46
Moderate	153	39.23
High	87	22.31
Total	390	100.00
Mean	14.73	
SD	1.64	

7.0 Energy Management Practices of The Family (EMPF)

One of the objectives of the study was to assess the energy management practices of the family. A descriptive rating scale to measure energy management practices of families (EMPF) was developed.

It was observed that nearly one-seventh of the families belonged to either of the extreme levels of EMPF. Nearly 72 per cent of families who earned 47 to 58 scores belonged to moderate category (Table 15). The proportion of families in high score category was remarkably more in Sindhrot than that of the other two villages. On the other hand, a greater proportion of families in Vadadla earned low scores revealing poor management practices while more or less the same proportion of families from Kanjari fell in the high or low scorer groups (Appendix IV : Table 21). The overall mean EMPF score was 52.50. The corresponding mean EMPF scores for Sindhrot, Kanjari and Vadadla were 54.84, 51.88 and 50.85 respectively.

Table 15: Distribution of Families by EMP

EMP	N	%
Low	53	13.59
Moderate	278	71.28
High	59	15.13
Total	390	100.00
Mean	52.52	
SD	5.58	

8.0 Extent of Interaction of Main Cook and Family with Different Spheres (EIMCDS and EIFDS)

The spheres of interaction were studied mainly in terms of contact of main cooks and families with immediate environment, near environment and larger environment. Findings related to EIMCDS are presented first followed that those of EIFDS. The mean score on extent of interaction with different spheres (EIDS score) was 55 in the case of main cooks. The range in the same was observed to be 30 to 98. Relatively a smaller proportion of main cooks belonged to either of the extreme levels by EIDS score. About 77 per cent of main cooks were moderate EIDS scorers (Table 16). The EIDS score of nearly half the main cooks ranged from 61 to 70. Those from Vadadla exhibited the highest EIDS score, while those from the other two villages revealed more or less the same EIDS score (Appendix IV : Table 22).

Table 16: Distribution of Main Cooks and Families by EIDS

EIDS	Main Cook		Family	
	N	%	N	%
Low	58	14.87	52	13.33
Moderate	301	77.18	282	72.31
High	31	7.95	56	14.36
Total	390	100.00	390	100.00
Mean	55.02		242.92	
SD	12.06		107.37	

About one-seventh of the families each could be seen as revealing high and low EIDS scores respectively. The mean EIDS score of families was estimated to be 242.92 with an SD of 107.37 which revealed remarkable variation in EIFDS (Table 16). Families' EIDS score ranged from 42 to 551. About one-fourth of them each had EIDS score ranging from 151 to 200 and 201 to 250 respectively (Appendix IV : Table 23).

9.0 Energy Consumption Pattern

9.1 Type of Fuel Consumed for Cooking

It was thought worthwhile to ascertain the cooking fuels used for cooking by beneficiary families of MCs covered in the study. Cent per cent of the families used fuelwood and agrowaste for cooking purpose. About 52 per cent and 42 per cent used dungcake and kerosene respectively in addition to fuelwood and agrowaste for cooking purpose. On the other hand, a very negligible proportion consumed electricity for the same(Table 17).

A greater proportion of families (71 per cent) in Sindhrot were consumers of kerosene for cooking purpose as compared to the other two villages. More or less the same proportion (55 to 57 per cent) of families in Sindhrot and Vadadla used dungcake while the same was true in the case of 44 per cent families in Kanjari (Appendix IV : Table 24).

The observation of the present study that biomass formed the most dominant cooking fuel source in rural areas with kerosene as a stand-by fuel compared well with that of Sharan and Gopinath (1983), Natarajan (1985), Goel (1986), Sharan (1986), and Vingle (1987). George and Vingle (1990) reported the distribution of

Table 17: Distribution of Families by Type of Fuel Consumed for Cooking

Type of fuel	N	%
Fuelwood/agrowaste	390	100.00
Dungcake	204	52.31
Kerosene	164	42.05
Electricity	4	1.02

Total exceeds cent per cent due to multiple response.

families covered in their study that consumed fuelwood by 99.24 per cent, kerosene by 33.33 per cent, and dung cake by 24.24 per cent. The observation of the present study that 52 per cent used dungcake for cooking in contrast to the findings of George and Vingle (1990) reveals the extent of dependency and extent of diversion of dungcake, an organic waste, from field to cookstove in recent years.

9.2 Reasons for Using Particular Cooking Fuel

Reasons for using particular cooking fuels by their families was reported by main cooks. A majority of them (90 per cent) used fuelwood because it was `economical'. A little over half of the families depended on fuelwood as it was easy to use. `Speed' and `free availability' were the reasons reported by a negligible proportion of main cooks for using fuelwood.

Nearly 46 per cent reported - `free availability' as the reason for using dungcake for cooking, while negligible proportions - 8.9 and 5.9 per cent - respectively - felt that dungcake was `easy to use' and `economical'. To one-fourth of the families each `ease in use' and `speed' were the reasons for using kerosene. `Speed' was the only reason for using electricity by its consumers (Table 18). In Vadadla 81 per cent

Table 18: Distribution of Families by Reasons for Using Particular Cooking Fuels

Reasons	Fuelwood N	Fuelwood %	Dungcake N	Dungcake %	Kerosene N	Kerosene %	Electricity N	Electricity %
Easy in use	212	54.36	35	8.97	101	25.89	-	-
Free availability	34	8.72	180	46.15	-	-	-	-
Economy	352	90.26	23	5.90	65	16.67	-	-
Speed	9	2.31	-	-	95	24.36	4	1.02
NA	-	-	186	47.69	226	57.95	386	98.97

Total exceeds cent per cent due to multiple response.

used fuelwood as it was `economical'. To 53 per cent of the families in Sindhrot `ease in use' was the reason for using kerosene (Appendix IV : Table 25).

9.3 Details Regarding Cooking Fuel Procurement

9.3.1 Mode of Procurement of Fuelwood

The main cooks reported about the mode of procurement of fuelwood. It was seen that about 84 per cent of the families depended on gathered fuelwood while 24 per cent depended on purchased wood. Further scrutiny revealed that while 76 per cent depended only on gathered fuelwood, 16 per cent depended only on purchased, and 8 per cent depended on both gathered and purchased fuelwood (Table 19). The number of families who purchased fuelwood was higher in Kanjari than that of the other two villages (Appendix IV : Table 26).

The finding of the present study that 84 per cent depended on gathered biomass compares well with that of Vingle (1987). Goyal (1985) reported that nearly 50 per cent of the sample studied gathered fuelwood and cent per cent gathered agrowaste.

9.3.2 Distance Travelled in Procuring Fuelwood

In relation to the distance travelled one way, to gather fuel, it was found that one-third of the families covered 0.5 to 1 km while one-fifth of them covered a distance of less than 0.5 km. About 18 per cent of the families trekked 1 to 1.5 km in

Table 19: Distribution of Families by Mode of Procurement, Distance Travelled and Mode of Transportation of Fuelwood

Fuel procurement details	N		%
Mode of procurement			
Gathered	297		76.15
Purchased	63		16.15
Gathered & purchased	30		7.69
Total	390		99.99
Distance (km)			
< 0.5	78		20.00
0.5-1	118		30.26
1-1.5	70		17.95
1.5-2	43		11.02
2-3	49		12.56
> 3	16		4.10
No Response	16		4.10
Total	390		99.99
Mean		2.77	
SD		1.46	
Mode of transport			
Headload	253		64.87
Headload and bicycle	60		15.38
Bicycle	43		11.03
Headload and camelcart	15		3.85
Bullock/camelcart	12		3.08
Tractor	4		1.02
Headload and Tractor	3		0.77
Total	390		100.00

search of fuel for cooking. More or less an equal proportion of families travelled a distance of either 1.5 to 2 km or 2 to 3 km. A negligible proportion covered more than 3 km for cooking fuel (Table 19).

Villagewise scrutiny revealed that more families in Sindhrot covered greater distance than those in Kanjari and Vadadla to procure cooking fuel forms. This shows that cooking fuel source is relatively farther away in this village than that of the other two villages (Appendix IV : Table 27). The findings of the present study differed from those of Chauhan (1985) and Vingle (1987), who reported that their rural sample covered a total distance of 1 to 3 km to and fro to gather fuelwood. The mean distance covered as reported by Chauhan (1985) was 2.29 km for bothways against 2.77 km one way in the present study. George (1986), Rao (1990), and Gusain and Pandey (1991) reported that on an average each rural household walked about 3-6 km daily in search of fuelwood.

9.3.3 Mode of Transporting Fuelwood

Data on transportation of fuel from its source to its destination - kitchen/homestead - revealed that many families resorted to a combination of modes of which the most common was carrying it by headloads (83 per cent). The quantity in each headload was observed to vary depending on who carried it, how much time was spent in fuel collection and from where it was procured. The summary of findings presented in Table 19 revealed that 65 per cent depended only on carrying by headloads while smaller proportion of families resorted to carrying headloads in

combination with bringing by bicycle, camelcart or tractor. Less commonly used modes of transportation of cooking fuel were bullock/camel cart, and tractor (Table 19). The villagewise findings revealed that the incidence of camelcart was observed only in Kanjari, and that of bicycle more commonly in Sindhrot (Appendix IV : Table 28). Neelakanthan (1991) reported that in Tamilnadu, rural households carried fuelwood mostly by headloads.

9.3.4 Source of Fuel Procurement

Nearly 60 per cent of the beneficiary families procured fuelwood from wayside or forestland followed by 35 per cent who procured from their own farms. More or less an equal proportion depended on the market in the nearby town, and/or village for their fuelwood (Table 20). The proportion of families who gathered fuelwood free of cost was more or less comparable in all the three villages. However the proportion of families who purchased fuelwood varied from village to village, the highest being observed in Sindhrot (Appendix IV : Table 29).

Goyal (1985) reported that 45 per cent of the rural sample studied gathered fuelwood from their own farm and 55 per cent from others' farm,while NCAER (1993) revealed that 48.5 per cent rural population depended on own trees for fuelwood, 29.8 per cent on road side bushes and trees, 17 per cent on nearby forest. Sharan and Gopinath (1983), Mehta et al., (1987), Veena (1988), Patel (1989), Gusain and Pandey (1991) and Neelakanthan (1991) observed that the sources of fuel in rural areas are own farm, neighbourhood, nearby places, public forests and market.

Table 20: Distribution of Families by Source of Procurement

Source of procurement	Fuelwood N	Fuelwood %	Dungcake N	Dungcake %	Kerosene N	Kerosene %
Own farm	138	35.38	9	2.31	-	-
Others's land	5	1.28	-	-	-	-
Wayside/forest	231	59.23	191	48.97	-	-
Own & wayside	-	-	4	1.02	-	-
Nearby town	42	10.77	-	-	81	20.77
Nearby village	51	13.08	-	-	25	6.41
Local shop	-	-	-	-	194	49.74
Rationshop	-	-	-	-	57	14.61

Total exceeds cent per cent due to multiple response.

Dungcake was reported as a cooking fuel by 52 per cent of the beneficiaries covered under the study. However it was not purchased by any family. Further analysis on its source showed that nearly 50 per cent collected dung from waysides and negligible proportion depended on their own cattle for the same. The women in these families made dungcakes by themselves. Villagewise breakup revealed that nearly half the sample in Kanjari, Vadadla and Sindhrot used dungcake as a cooking fuel (Appendix IV : Table 29).

Though kerosene formed a source of fuel for domestic use in 91 per cent of the families, only 42 per cent used it for cooking. Local shop was the main source of kerosene for 50 per cent of the beneficiary families. Nearly one-fifth of the

families purchased kerosene from nearby town followed by 15 per cent who purchased it from fair price shop. Villagewise analysis revealed variation in source from where the families procured kerosene (Appendix IV : Table 29).

9.3.5 Number of Males and Females Involved in Fuel Gathering

The number of male/female persons involved in fuel gathering ranged from 1 to 7. In 57 per cent families male members were involved in fuel procurement task in contrast to 91 per cent families where female members were involved in the task. The proportion of families where one male or female member was responsible for fuel procurement was the highest with that of 2 male /female members being the next most common. The mean number of female and male members involved in fuel collection was 1.33 and 1.46 respectively (Table 21).

The proportion of families where one female member was involved in fuel gathering was more or less the same in all the three villages. On the other hand, the distribution of families where one male member was involved in fuel gathering was the least in Vadadla while it was the highest in Sindhrot (Appendix IV : Table 30).

Mean number of family members involved in procuring fuel irrespective of gender was 3.00 with an SD of 1.47. In majority of the families 2 persons were involved. Villagewise analysis revealed that there was not much variation in regard to total

Table 21: Distribution of Families by Number of Males and Females Involved in Fuel Gathering

No. of persons	Male N	Male %	Female N	Female %	Total N	Total %
0	169	43.33	37	9.49	-	-
1	167	42.82	232	59.49	7	4.36
2	41	10.51	85	21.79	194	49.74
3	12	3.08	30	7.69	61	15.64
4	-	-	5	1.28	53	13.59
5	-	-	1	0.26	34	8.72
6	-	-	-	-	20	5.13
7	1	0.26	-	-	7	1.79
8	-	-	-	-	4	1.03
Total	390	100.00	390	100.00	390	100.00
Mean	1.33		1.46		3.00	
SD	0.68		0.73		1.47	

number of family members involved in fuel procurement task. According to Chauhan (1985), the mean number carrying out this task was 2.45 and Vingle (1987) found that in majority of the households 1 to 3 persons were involved in gathering fuelwood.

9.4 Storage of Fuel and Related Problems

Nearly 63 per cent families stored fuel either in verandah or any room while 43 per cent used backyard for the same (Table 22). To nearly one-third of the families kitchen corner formed the storage area for cooking fuel. Further analysis by village

Table 22: Distribution of Families by Place of Fuel Storage and Related Problems

Storage place and problems	N	%
Storage place		
Any room/verandah	244	62.56
Backyard	168	43.08
Kitchen corner	146	37.43
Problems in Storage		
Lack of storage space	246	63.08
Absence of sheltered space to store during monsoon	226	57.95
Messy appearance	186	47.69
Danger of fire	39	10.00

Total exceeds cent per cent due to multiple response

revealed that any room/verandah proved to be the fuel storage area for 69, 63, and 55 per cent families in Vadadla, Sindhrot and Kanjari while backyard was the most popular storage place for fuel storage in case of 77 per cent families in Kanjari. About 30 per cent or less than that reported the same in Sindhrot and Vadadla. Kitchen corner proved to be the main storage area for 72 per cent in Sindhrot (Appendix IV : Table 31). Thus variations were observed from village to village with reference to the most common fuel storage area.

Chauhan (1985) in her study found that 50 per cent stored fuel in attic, and the rest stored it either in the backyard, frontyard or in the room itself. Sangwan et al., (1987) in their study observed that courtyards were the most popular places for storing sticks and wood. Vingle (1987) found that main room (35.6 per cent) and backyard (24 per cent) were the major places of fuel storage.

The problems faced with reference to fuel storage was explored. By and large, majority of the beneficiary families had semipucca houses to stay (Table 7) with one or two rooms (Appendix IV : Table 32). Most of the beneficiary families (63 per cent) reported that `lack of storage space' was the main problem in their already substandard housing. To nearly 58 per cent of the families, `absence of a sheltered storage area' was a problem especially during monsoon season as their preferred storage area for cooking fuel was backyard. `Messy appearance' and `danger of fire' were the other problems in storing for 48 per cent and 10 per cent of families respectively. Villagewise analysis revealed that `lack of storage space' and `absence of a sheltered space' especially during monsoon season were the problems felt by majority of the families in Kanjari and Sindhrot, while `messy appearance' seemed to be a major problem felt by majority of the families in Vadadla (Appendix IV : Table 31).

9.5 Average Monthly Consumption and Expenditure on Fuelwood and Kerosene

9.5.1 Fuelwood

It was observed that though cent per cent used fuelwood for cooking only 24 per cent of beneficiary families purchased the same (Table 20). The mean quantity of fuelwood purchased was computed to be 68 kg per month (Table 23). Maximum proportion of families (47 per cent) who purchased fuelwood belonged to Sindhrot with the least proportion (3 per cent) belonging to Kanjari. While nearly 20 per cent families in Sindhrot and 5 per cent in Vadadla purchased 26 to 50 kg fuelwood per month, 14 per cent in Sindhrot and 6 per cent in Vadadla bought 76 to 100 kg and more or less an equal proportion of families of both Sindhrot and Vadadla purchased >101 kg and <25kg fuelwood per month respectively (Appendix IV : Table 33).

Vingle (1987) in her study found that 30 per cent of the sample studied from Jaspur village, Padra Taluka, purchased fuelwood in contrast to 24 per cent of the present study. The variation in the findings might be due to increase in price of fuel over the years which prompted families to go for gathered fuelwood by travelling longer distances than purchasing. It could also be due to shift in fuel from fuelwood to agrowaste and dungcake or mix of fuels consumed.

Table 23: Distribution of Families by Average Monthly Consumption and Expenditure on Fuelwood and Kerosene

Consumption	N	%	Expenditure in Rs.	N	%
Fuelwood (kg)					
10-25	9	2.31 (9.68)	10-25	13	3.33 (13.98)
26-50	33	8.46 (35.48)	26-50	34	8.72 (36.56)
51-75	14	3.59 (15.05)	51-75	10	2.56 (10.75)
76-100	27	6.92 (29.03)	76-100	30	7.69 (32.26)
101 & above	10	2.56 (10.75)	101 & above	6	1.54 (6.45)
NA	297	76.15	NA	297	76.15
Total	93	23.84 (99.99)	Total	93	23.84 (100.00)
Mean	(68.08)			(66.67)	
SD	44.45			42.26	
Kerosene (lt)					
5	266	68.21 (74.51)	upto 20	284	72.82 (79.55)
6-10	76	19.49 (21.29)	21-40	52	13.33 (14.57)
11-15	11	2.82 (3.08)	41-60	13	3.33 (3.64)
16 & above	4	1.02 (1.12)	61-80	8	2.05 (2.24)
NA					
Total	357	91.54 (100.00)	Total	357	91.53 (100.00)
Mean	(4.00)		Mean	(15.59)	
SD	3.41		SD	13.48	

Figures in parentheses indicate percentage out of relevant cases.

Further analysis was done to gain insight into the expenditure on fuelwood. The price of fuelwood ranged from Rs.0.70 to Rs.0.90 in Kanjari, and Rs.0.80 to Rs.1.00 in Vadadla and Sindhrot. The range of monthly outlay was from Rs.7.00 to Rs.300.00. Out of those families who purchased fuelwood, 37 per cent spent Rs.26.00 to 50.00 per month and 32 per cent spent Rs.76.00 to Rs.100.00 per month. A very negligible proportion (6 per cent) spent more than Rs.100.00 per month on fuelwood (Table 23). The overall mean monthly expenditure of the families who purchased fuelwood was Rs.66.67 with an SD of 42.26.

9.5.2 Kerosene

Kerosene is a commercial fuel consumed by rural families. Data related to this on analysis revealed that 92 per cent of the families bought kerosene for cooking and lighting purposes. The mean consumption was estimated at 4.00 lt with an SD of 3.41 which revealed relatively high degree of variability amongst its consumers. The consumption ranged from 1 to 25 lt on an average per month. The majority (68 per cent) revealed an average monthly consumption of 1 to 5 litres (Table 23). A negligible proportion consumed more than 10 lt a month. In Kanjari cent per cent of the families bought kerosene out of which 98 per cent consumed 1 to 5 lt on an average per month. In the case of more or less an equal proportion (51 to 54 per cent) of families in the other two villages too, similar findings were observed. Nearly one-third in village Sindhrot and one-fifth in Vadadla bought 6 to 10 lt of kerosene on an average per month (Appendix IV : Table 34).

The cost price of kerosene was Rs.3.00 to Rs.5.00 per litre at the time of the study. Regarding the average monthly expenditure, it was observed that 73 per cent families spent Rs.20.00 or less. Approximately one-eighth of the families spent Rs.21.00 to Rs. 40.00 per month. Negligible proportion of families spent more than Rs.40.00 per month on kerosene. Mean monthly expenditure on kerosene was Rs.15.59 in the case of its consumers (Table 19). However Gusain and Pandey (1991) reported that rural people in Orissa spent Rs.100 to 150 per month.

9.5.3 Electricity

Findings revealed that 81 per cent of the beneficiary families had electricity in their homes while the rest were not consumers of this public utility. However in village Kanjari 99 per cent had electricity in their homes followed by Vadadla (78 per cent) and Sindhrot (67 per cent) in descending order.

The data on quantum of power consumption could not be procured from the sample for want of the documents (bills) with them. However the data on the amount of payment made once in two months on electricity were furnished by the respondents from which the average monthly expenditure was computed.

Though 81 per cent of the families were consumers of electricity, only 80 per cent were observed to be paying for electricity. A negligible percentage, (2 per cent) spent on an average Rs.41.00 to Rs.60.00 per month on electricity. The mean monthly outlay on electricity was computed to be Rs.22.04 in the

Table 24: Ditribution of Families by Monthly Expenditure on Electricity

Expenditure in Rs.	N	%
≤ 20	158	40.51 (50.80)
21-40	147	37.69 (47.27)
41-60	6	1.54 (1.93)
NA	79	20.26
Total	390	100.00
Mean	22.04	
SD	9.02	

Figures in parentheses indicate percentage out of those families who consume electricity.

relevant cases (Table.24). Nearly 84 per cent of the families in Kanjari paid Rs.5.00 to RS.20.00 per month. The monthly expenditure on electricity in the case of more or less 50 per cent of families' ranged from Rs.21.00 to Rs.40.00 in both Vadadla and Sindhrot (Appendix IV : Table 35).

The average monthly expenditure incurred on electricity consumption by rural families was seen to be abysmally low in comparison to that of urban families which was reported to be Rs.55.83 per month (George, 1981) Rs.116.71 per month (Kaul, 1984; George, 1986) and Rs.134.61 per month (Talati,1986). The findings were more or less comparable with that of Gusain and

Pandey (1991), who reported that the rural sample in their study spent Rs.28.00 per month on electricity.

9.11 Total Monthly Expenditure on All Purchased Fuels

Monthly expenditure on the various forms of energy availed of was computed from the data collected. A little less than one-

Table 25: Distribution of Families by Total Monthly Expenditure on All Purchased Fuels

Expenditure in Rs.	N	%
≤ 25	125	32.05
26-50	118	30.26
51-75	59	15.13
76-100	32	8.20
101-125	21	5.38
126-150	16	4.10
151 & above	19	4.87
Total	390	99.99
Mean	55.90	
SD	48.50	

third of the families each spent Rs.≤25.00 and Rs.26.00 to Rs.50.00 on an average per month on all fuel forms. Nearly one-seventh of the families fell in the range of Rs.51.00 to Rs.75.00 while a small proportion of them spent more than Rs.75.00 per month on the same. Mean monthly expenditure on all purchased fuels including diesel and petrol amounted to be Rs.56.00 (Table

25) with the mean monthly expenditure on fuels like biomass, kerosene and electricity being Rs.52.17. A greater proportion of families in Kanjari spent Rs.<25.00 per month on fuels as compared to that of the other two villages (Appendix IV : Table 36).

9.10 Main Cook's Perception Regarding Scarcity of Fuel (MCPRSF) During 1991-92 as Compared to 2 Years Ago and 5 Years Ago

Majority of the cooks perceived that fuelwood and kerosene were scarce more during 1991-92 as compared to 2 or 5 years ago. A negligible proportion of respondents felt that agrowaste and kerosene became more scarce during 1991-92 as compared to 2 or 5 years ago. Scarcity with reference to agrowaste was reported `same' during 1991-92 and 2 or 5 years ago by nearly one-fourth of the respondents (Table 26). More scarcity of fuelwood was felt during 1991-92 by 89 per cent and 81 per cent from Sindhrot and Vadadla respectively. In Kanjari majority of the cooks did not find any difference in the supply situation of any fuel in the past 5 years (Appendix IV : Table 37). NCAER (1993) observed that 80 per cent of the rural households reported `less availability' of fuelwood at the time of their study as compared to 5 years back.

Table 26: Distribution of Families by MCPRSF 1991-92 compared to 2 years ago and 5 years ago

Fuels	Scarcity 2 years ago N	Scarcity 2 years ago %	Scarcity 5 years ago N	Scarcity 5 years ago %
Fuelwood				
Less	-	-	-	-
Same	128	32.82	123	31.54
More	262	67.18	267	68.46
Total	390	100.00	390	100.00
Agrowaste				
Less	-	-	-	-
Same	86	22.05 (67.72)	86	22.05 (67.72)
More	41	10.51 (32.28)	41	10.51 (32.28)
No response	263	67.44	263	67.44
Total	390	100.00	390	100.00
Dungcake				
Less	-	-	-	-
Same	8	2.05 (57.14)	8	2.05 (57.14)
More	6	1.54 (42.86)	6	1.54 (42.86)
No response	376	96.41	376	96.41
Total	390	100.00	390	100.00
Kerosene				
Less	-	-	-	-
Same	146	37.43 (40.90)	136	34.87 (38.10)
More	211	54.10 (59.10)	221	56.67 (61.90)
No response	33	8.46	33	8.46
Total	390	100.00	390	100.00

Figures in parentheses indicate percentage out of relevant cases.

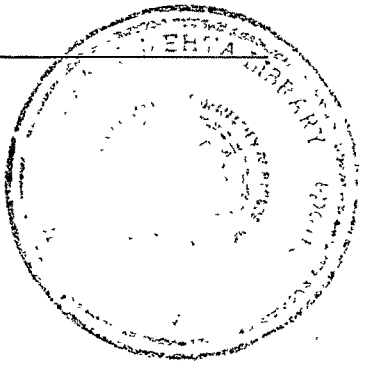
10.0 Perception Regarding Available Cooking Fuel Sources (PRACFS)

In order to measure PRACFS, the sources of commercial and non-commercial cooking fuels were considered. Fuelwood was observed to have entered the market economy. The respondents were asked to report on their perception regarding available sources of cooking fuel. A checklist of available sources of cooking fuels, viz., local and nearby markets, forest/wasteland and own/private farm for each of the cooking fuels were provided for respondents to choose from. A score of 1 was given to an available source indicated with `zero' assigned if not indicated. The total score on all available sources perceived formed the PRACFS score. The observed PRACFS scores ranged from three to seven. Nearly half-of them revealed moderate PRACFS while a little over one-third of them exhibited low PRACFS scores. Only 11 per cent of main cooks earned a PRACFS scores above 6.34 and thus belonged to the category of high scorers. The mean PRACFS score of 5.26 revealed quite high perception regarding available sources of cooking fuel (Table 27). Villagewise findings revealed that the PRACFS score of respondents fell at 4 or less in nearly 95 per cent cases in Kanjari, it was 5 to 6 in the case of 89 per cent in Vadadla and 6 to 7 in 91 per cent of them in Sindhrot. The mean PRACFS scores of the respondents were computed to be 4, 5.5 and 6.2 for Kanjari, Vadadla and Sindhrot respectively (Appendix IV : Table 38).

Further scrutiny of data revealed that market in nearby town and nearby village were the sources reported by nearly cent per

Table 27: Distribution of Families by PRACFS

Category	N	%
Low	141	36.15
Moderate	206	52.82
High	43	11.03
Total	390	100.00
Mean	5.26	
SD	1.08	



cent of the main cooks for kerosene and own/private farm for non-commercial fuels, i.e., mainly fuelwood (Appendix IV : Table 39). Villagewise analysis showed that majority of them from Vadadla and Sindhrot reported that kerosene could be purchased from local market though none of the beneficiaries from Kanjari felt they could do in this regard or fuelwood. While one-third from Sindhrot reported their local market as a source of cooking fuelwood, none from Vadadla responded in the affirmative (Appendix IV : Table 40).

11.0 Perception Regarding Accessibility to Available Cooking Fuel Sources (PRAACFS)

The perception regarding accessibility to fuel sources was assessed to find out its relationship with adoption of MC by its beneficiaries. The range of scores earned by respondents was one to six. The mean score was found to be 2.63 (Table 28). Nearly 89 per cent studied belonged to the category of moderate PRAACFS

scorers. A negligible proportion belonged to either of the extreme levels of PRAACFS. The computed low mean score on PRAACFS implies that though their perception regarding available cooking fuel sources was relatively high (Table 27), their perception regarding accessibility to fuel sources was comparatively very low. In other words, they were cognizant about the limited sources to which they had accessibility. The analysis of data on PRAACFS villagewise showed that majority earned a score of 2 or 3 irrespective of the village to which they belonged (Appendix IV : Table 40).

Table 28: Distribution of Families by PRAACFS Score

Category	N	%
Low	28	7.18
Moderate	347	88.97
High	15	3.85
Total	390	100.00
Mean	2.63	
SD	1.52	

Further analysis revealed that nearly half of the cooks felt that the nearby village market was accessible to them to buy kerosene (Table 28). However only two-third and one-third of the cooks felt that the forest land/wasteland and private land respectively were accessible to them. While 95 per cent from Kanjari felt that the nearby village market was accessible to them to buy kerosene, relatively fewer respondents from Vadadla

and Sindhrot felt that their nearby village markets were accessible to them for commercial fuels like kerosene and fuelwood (Appendix IV : Table 41).

12.0 Participation in Cooking Fuel Cycle

Fuel procurement, transportation, preparation of fuel for use in chulha, cooking, and cleaning up, were the different tasks related to cooking fuel cycle in which family involvement was explored.

12.1 Participation of Family Members by Gender Cooking Fuel Cycle

It was found that in 99 per cent of families, female members were responsible for preparation of fuel, cooking and cleaning up and only in four families male members were responsible for these activities (Table 29). However male participation was more

Table 29: Distribution of Families by Male and Female Members Involved in Cooking Fuel Cycle

Cooking fuel cycle	M		F	
	N	%	N	%
Fuel procurement	221	56.67	353	90.51
Transporting	275	70.51	349	89.49
Preparation of fuel	4	1.03	387	99.23
Cooking	4	1.03	387	99.23
Cleaning	4	1.03	387	99.23

Total exceeds cent per cent due to multiple response.

in fuel procurement (57 per cent) and transporting the fuel home (70.5 per cent). The findings were more or less the same in all the villages (Appendix IV : Table 42).

The findings of a study undertaken by NCAER (1993) that in 52 per cent of the households, collection of fuel was being done by male members compares well with the findings of the present study.

12.2 Age to start Participation in Cooking Task at Chulha

The age at which the respondents (main cooks) started participation in cooking at chulha and the age at which they expected or made their children participate in the same task was reported by them. The data revealed that majority of the cooks (89 per cent) and their daughters (60 per cent) started cooking between the ages of 10 and 15 years (Table 30). However in about one-tenth of the families, cooks started cooking at the tender age of 9 years or less while only in a very negligible proportion of families, i.e., one-twentyfifth, the same was true in the case of their daughters. The observations of the study indicated that female children started their involvement in cooking task very early in life, since the initiation of their participation in this task after 15 years of age was a very rare phenomenon. Vingle (1987) found that the majority of the respondents and their daughters started cooking at the age of 10 years, as against the findings of the present study. Over a period of five to six years from 1987 to 1993, a slight change in the age at which a girl child is made to participate in cooking at chulha is

indicated. A girl child in contrast to a male one, thus is exposed to pollutant emissions from chulhas from a very tender age.

Table 30: Distribution of Families by Age of Daughter and Main Cook Started Cooking

Age	Daughter		Main Cook	
	N	%	N	%
<10 yrs	15	3.85	37	9.49
10 -14 yrs	232	59.49	347	88.97
15 - 17yrs	3	0.77	3	0.77
> 17 yrs	-	-	3	0.77
NA	140	35.90	-	-
Total	390	100.00	390	100.00

Villagewise distribution revealed that 10 to 15 years was the age during which majority of the cooks and daughters started cooking irrespective of the village to which they belonged. However in Vadadla and Sindhrot, the three male cooks of the study started cooking at the age of 24 to 26 years and 42 years respectively due to exigent situations that arose in their lives (Appendix IV : Table 43).

13.0 Practices Related to Family Cooking

13.1 Family Meal Pattern and Cooking Methods

Meal pattern of beneficiary families was ascertained in terms of number and type - simple to complex - of meals served, and cooking methods followed in meal preparation.

It was observed that a little less than fifty per cent of the families cooked and served meals and tea twice a day. Next in declining order was the practice of cooking and serving two meals and one tea (27 per cent), and two meals and tea twice with snacks once (21 per cent) daily. Only a negligible proportion of families served just two meals daily (Table 31). The proportion of families that cooked and served meals and tea twice a day was

Table 31: Distribution of Families by Meal Pattern and Cooking Methods

Details	N	%
No. of meals		
Two meals & two tea	190	48.72
Two meals & one tea	106	27.18
Two meals & one tea & one tea snack	81	20.77
Two meals & one tea snack	10	2.56
Two meals	3	0.77
Total	390	100.00
Type of meal		
Simple	351	90.00
Somewhat complex	39	10.00
Total	390	100.00
Cooking methods		
Boiling	386	98.97
Roasting	390	100.00
Steaming	15	3.85

the highest in Sindhrot (61 per cent). Two meals and one tea were served in nearly one-third, while two meals and tea twice with snack once a day were observed in one-fourth of the families of Kanjari and Vadadla respectively with those in Sindhrot revealing the lowest incidence in this regard (Appendix IV : Table 44).

It was thought worthwhile to gain insight into the nature of meal prepared and cooking methods followed daily by the beneficiary families. A meal was categorised as simple if it contained one or two items for both the main meals or one item for one meal and two items for the other meal. If each of the meals comprised of 3 items, or 2 items for one meal and 3 items for the other, it was identified as somewhat complex meal.

Nearly 90 per cent of the families took simple meals daily, i.e., 2 items each for both the meals or one item for one meal and 2 items for the other meal (Table 31). Mostly rotla-an unleavened bread made of pearl millet (bajra)-, and sabji (vegetable) for lunch, and khichdi-a composite meal of rice and pulses-, and kadhi-seasoned butter milk-, for dinner were the common items prepared in more or less all the families (Appendix IV : Table 45). Somewhat complex meal was prepared by only 10 per cent in which they had 3 items each for lunch and dinner or 2 items for one meal and 3 items for the other meal (Table 31). More or less similar meal pattern was observed in the case of all beneficiary families irrespective of the village to which they belonged (Appendix IV : Table 44).

About cent per cent of the families followed boiling and roasting methods of cooking as their daily menu was mostly khichdi and rotla accompanied by vegetable preparation or kadhi. A very few families steamcooked dishes (Table 31). Villagewise analysis revealed comparable findings among all the three villages (Appendix IV : Table 44).

13.2 Timing of Different Cooking Tasks

On an average, life in villages begins with the break of the day. It was observed that the use of traditional rural chulha (TRC) centered around the meal pattern of the user family. Thus timing of different cooking tasks in the course of the day, during which the chulha was put to active use, could be identified and categorised as early morning hours (6.00 a.m. - 10.30 a.m.), late midmorning to afternoon hours (11.00 a.m. - 3.00 p.m.) and evening hours (5.30 p.m. - 9.00 p.m.).

The findings related to the timing of different cooking tasks in the course of the day are presented in Table 32. Heating water for bathing (80 per cent) and making tea (78 per cent) were the major activities done in the early morning hours of the day. More or less an equal proportion of families prepared mid-day meals, tea and snacks in the early morning hours. Less than 10 per cent prepared animal feed in the early morning hours. In the case of nearly 14 per cent no cooking task was attended to during the early morning hours.

Table 32: Distribution of Families by Timing of Different Cooking Tasks

Cooking tasks	Early morning hours		Late morning & early afternoon hours		Evening hours	
	N	%	N	%	N	%
Meal pre-paration	67	17.18	367	94.10	390	100.00
Water heating	313	80.26	76	19.49	72	18.46
Tea & snack	81	20.77	-	-	-	-
Tea alone	305	78.20	263	67.43	3	0.77
Animalfeed	32	8.20	18	4.61	-	-
None	54	13.85	9	2.31	-	-

Total exceeds cent per cent due to multiple response.

Mid-day meal (lunch) preparation was the main cooking task performed by 94 per cent beneficiaries which was followed by making only afternoon tea without any snack (67 per cent) during 11.00 a.m. to 3.00 p.m. period. Heating water for bathing purpose was carried out by more or less an equal proportion of families during late mid morning-early afternoon hours and evening hours in the course of the day when TRC was put to active use. Further scrutiny of data revealed that those who stayed at home started their mid-day meal preparation around 11.00 a.m. while those who were subsistence farm women and/or farm labour returned from their work and started their cooking around 12.30 p.m. to 1.00 p.m. A small proportion of subsistence farm families (17 per cent) prepared mid-day meal in the early morning hours and carried it with them to the field.

The evening cooking task started around 5.30 p.m. for those who stayed behind at home taking care of household chores, whereas for those who worked outside their home, the fire was lit for evening cooking around 6.30 p.m. or a little later. Cooking evening meal was performed by all while heating water was carried out by 19 per cent in the evening hours. Negligible proportion made tea in the late evening hours. Villagewise analysis revealed comparable findings in this regard (Appendix IV : Table 46).

13. 3 Cooking Area During Different Seasons Prior to Installation of MC

About 50 per cent of the families used kitchen for carrying out cooking irrespective of the seasons. A little over one-third of the families used a portion of one of the rooms in the dwelling unit for cooking purpose irrespective of seasonal variations. In some of these cases (24 per cent) the cooking area was separated from the rest of the room with a dwarf wall. About 10 to 14 per cent of the families cooked in the verandah and backyard, with the highest proportion doing so during summer months (Table 33). Seasonal variations with reference to cooking area was minimal. Villagewise analysis showed that the cooking area remained more or less same in all the three villages irrespective of seasonal variations except that of open yard which was used during summer months to a greater extent than at other times, the same being the most pronounced in Sindhrot (Appendix IV : Table 47).

Table 33: Distribution of Families by Cooking Areas in Different Seasons Prior to Installation of MC

Location	Summer		Monsoon		Winter	
	N	%	N	%	N	%
Open yard	28	7.18	20	5.13	16	4.10
Verandah without roof and wall	3	0.77	3	0.77	3	0.77
Verandah with roof and no wall	6	1.54	6	1.54	6	1.54
Verandah with roof and dwarf wall	17	4.36	17	4.36	16	4.10
Within the room with dwarf wall	94	24.10	95	24.36	95	24.36
Within the room without dwarf wall	49	12.56	49	12.56	50	12.82
Kitchen without dwarf wall	158	40.51	159	40.77	160	41.02
Kitchen with dwarf wall	35	8.97	41	10.51	44	11.28

14.0 Responses Related to Conventional/Traditional Cookstoves

14.1 Type of Stove Used Prior to Installation of MC

The main cooking units and supplementary units used by the beneficiary families prior to installation of MC were studied. Approximately in half of the beneficiary families more than one stove was used for cooking purpose.

Shielded `horse-shoe' shaped TRC was the main stove that was used by nearly cent per cent of the families (Table 34). The most prominent supplementary stove used for cooking purpose was kerosene stove which was reported by 42 per cent of the families

studied. In negligible proportion of families, open fire, electric stove and shielded `horse-shoe' shaped TRC were also

Table 34: Distribution of Families by Type of Stove Used Prior to Installation of MC

Type of Stove	Main		Secondary		Tertiary	
	N	%	N	%	N	%
Open fire	1	0.26	5	1.28	3	0.77
Shielded TRC	389	99.74	2	0.51	-	-
Kerosene stove	-	-	164	42.05	-	-
Electric stove	-	-	4	1.02	-	-
NA	-	-	215	55.13	387	99.23
Total	390	100.00	390	99.99	390	100.00

used as supplementary stoves. Villagewise analysis revealed that in Kanjari, open fire built of three bricks was used by one family for cooking purpose. Kerosene stove was used as a supplementary stove by 71 per cent, 48 per cent and 7 per cent families in Sindhrot, Vadadla and Kanjari respectively (Appendix IV : Table 48).

14.2 Items Cooked on Main and Supplementary Stoves

The respondents were asked to report on the items made on main and supplementary stoves. Almost cent per cent who used shielded `horse-shoe' shaped TRC as the main stove cooked full meals on it. The one family that reported open fire as the main stove used it for cooking its staple food - rotla and heating water. All the families (42 per cent) that used kerosene stove as

a supplementary stove, used it mainly to prepare tea while nearly 28 per cent used it to cook vegetables. A negligible proportion used electric stove for cooking rotla, khichdi, vegetable and tea (Table 35).

Shielded TRC was the main stove which was used extensively by the beneficiary families to cook meals which included khichdi, kadhi, vegetable, rotla and tea. The families were observed to use TRC in enclosed cooking area/kitchen as well as in open backyard or verandah.

Table 35: Distribution of Families by Items Cooked on Main and Supplementary Stoves

Items/Stoves	Main N=390				Secondary N=175								Tertiary N= 3	
	Openfire		Shielded TRC		Openfire		Shielded TRC		Kerosene		Electric Stove		Openfire	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Rotla	1	0.26	389	99.74	3	0.77	2	0.51	18	4.61	2	0.51	1	0.26
Rice & Dal	-	-	387	99.23	2	0.51	-	-	21	5.38	-	-	1	0.26
Heating water	1	0.26	387	99.23	-	-	-	-	5	1.28	-	-	-	-
Khichdi	-	-	386	98.97	1	0.26	2	0.51	33	8.46	2	0.51	-	-
Kadhi	-	-	386	98.97	1	0.26	1	0.26	5	1.28	-	-	1	0.26
Vegetable	-	-	385	98.72	-	-	-	-	109	27.95	3	0.77	1	0.26
Tea	-	-	385	98.72	-	-	-	-	164	42.05	4	1.03	1	0.26
Animal feed	-	-	50	12.82	-	-	1	0.26	-	-	-	-	1	0.26

Total exceeds cent per cent due to multiple response

TRC is reported to exhibit rather low efficiency and is subject to variations in performance under different conditions of operation, the same being of operation and 5 to 6 per cent efficiency under uncontrolled conditions of operation (Salariya,

1983) and 12 to 16 per cent under highly controlled conditions (Prasad and Verhaart, 1983).

14.3 Reasons for Preference to Cook on Main and Supplementary Stoves

It was thought worthwhile to find out the reasons for preferring the particular stove used as the main or supplementary cooking unit. All users of `horse-shoe' shaped TRC and open fire used the same as these were traditional cookstoves used in their families by their predecessors. About 94 per cent of respondents preferred to cook on shielded TRC as it could burn large quantities of varieties of biomass that formed cheap source of cooking fuel to them. Nearly 23 per cent stated that taste was better especially in case of rotla cooked on TRC. More or less an equal proportion (nearly one-fourth) gave `ease in cooking' and `ease in operation of stove' as the reasons for cooking on kerosene stove and electric sigdi (Table 36).

Table 36: Distribution of Families by Reasons for Their Preference to Cook on Main and Supplementary Stoves

Reasons/Stoves	Main N=390				Supplementary stoves: Secondary N=175								Tertiary N= 3	
	Openfire		Shielded TRC		Openfire		Shielded TRC		Kerosene		Electric Stove		Openfire	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Traditional Technology	1	0.26	366	93.85	-	-	1	0.26	-	-	-	-	-	-
Better taste	1	0.26	89	22.82	-	-	1	0.26	-	-	-	-	-	-
Easy cooking	1	0.26	32	8.20	-	-	-	-	97	24.87	4	1.03	1	0.26
Easy operation	1	0.26	3	0.77	2	0.51	-	-	93	23.85	3	0.77	1	0.26
As a supplementary unit	-	-	-	-	2	0.51	-	-	102	26.15	-	-	1	0.26

Total exceeds cent per cent due to multiple responses.

14.4 Maker of TRC and Material Composition

Information on maker of TRC and materials used in its construction were gathered. In 93 per cent of the families, TRC was constructed by main cooks (females) themselves. In less than 10 per cent of the families, other female family members or women in the neighbourhood made TRC. Local materials like mud,

Table 37: Distribution of Families by Maker of TRC and Material Composition of TRC

Details	Total N	Total %
Maker of TRC		
Self(Main cook)	363	93.08
Other female family members	15	3.84
Females in neighbourhood	12	3.08
Total	390	100.00
Material Composition of TRC		
Local materials	387	99.23
Local & commercial materials	3	0.77
Total	390	100.00

ash and fine dust were used for constructing TRC in 99 per cent families whereas cement plastering was done on mud chulhas in a negligible proportion of families (Table 37). Villagewise analysis revealed that the findings were comparable in this aspect in all the three villages (Appendix IV : Table 49).

14.5 Beliefs and Practices Regarding TRC

Beliefs regarding placement of TRC, and practices related to its use, fuel drying, mode of kindling fire and sitting position of cook near chulha were reported by the respondents. Nearly three-fourth of them reported certain beliefs regarding the direction to which chulha mouth should face while the rest did not report any such belief. The most prominent belief was to position the chulha such that its fuel feed opening faced West, the same being true in 69 per cent of the sample families. The rest of the directions were reported by negligible proportion of respondents (Table 38).

It was observed that chulha was lit as early as 6.00 a.m. by a good proportion of families. The stove was never continuously used from morning till evening. To find out whether the cooks put off fire totally in the chulha when there was a remarkable break in its use, the respondents were interrogated. It was found that fire was left idle in between cooking tasks by about 60 per cent families `sometimes' while nearly 20 per cent left the burning chulha idle `always'. Nearly 80 per cent sun-dried the fuel while only a small proportion dried the fuel on hot chulha. The rest did not take any special efforts to dry it.

Table 38: Distribution of Families by Beliefs and Practices Regarding TRC

Beliefs & Practices	N	%
Fuelfeed opening should face		
East	10	2.56
West	269	68.97
North east	5	1.28
South	3	0.77
North	2	0.51
None	101	25.89
Practices Fire left idle in between cooking tasks		
Sometimes	211	54.10
Always	68	17.43
Never	111	28.46
Drying of fuel for cooking		
Sundried	313	80.26
Dried on chulha	7	1.79
No specific practice	20	17.95
Materials used for kindling fire		
Kerosene	82	21.02
Paper	87	22.05
Both	221	56.67
Sitting positions		
In front of firebox	44	11.28
Left side of stove	263	67.43
Right side of stove	83	21.28

Approximately one-fifth of the families used either kerosene or paper to kindle fire. Both kerosene and paper were used for kindling purpose by 57 per cent of families. The proportion of families, who used paper to kindle fire, was more in Vadadla than that of the other two villages (Appendix IV : Table 50). Vingle's study (1987) revealed that majority (71.21 per cent) used small pieces of twigs along with fuelwood to start fire and 11.36 per cent used a little kerosene with small pieces of wood.

The sitting position of the cook by TRC while cooking was gathered with reference to the investigator facing fuelfeed opening side of stove. The data when analysed showed that about 11 per cent main cooks sat in front of firebox while cooking at the chulha. However in 89 per cent families, the cooks sat by the side of chulha while cooking. Amongst such families, in 76 per cent (67 per cent of the total), cooks sat by left side of chulha while the rest - 24 per cent (21 per cent of the total) -sat by right side. The proportion of cooks who sat by left side of chulha was the highest in Kanjari while more or less an equal proportion (one-fourth) of cooks in Vadadla sat in front of firebox or right side of chulha respectively. On the other hand, in Sindhrot 63 per cent main cooks sat by the left side of chulha while 31 per cent sat by the right side for cooking (Appendix IV : Table 50).

14.6 Utility of TRC for Non-Cooking Purposes

A shielded TRC consists of a shield or covering provided in an `horse-shoe' shape around the combustion chamber to protect

the fire from vagaries of wind,and control the air inflow to some extent. It does not have any provision to carry away smoke. Considerable energy is wasted due to undirected and wavering flame. Tending fire is required constantly to maintain continuous burning. If unattended TRC produces a lot of smoke in the cooking area leading to eye discomfort and respiratory disorders. Moreover, it dissipates heat due to radiation and raises environment temparature.

Table 39: Distribution of Families by Utility of TRC for Non Cooking Purposes

Uses	N	%
Heat		
Keeps away insects	55	14.10 (79.71)
Gives warmth	5	1.28 (7.25)
None	332	85.13
Smoke		
Preserves food	38	9.74 (35.85)
Keeps away insects	37	9.49 (34.90)
Preserve thatch roof	31	(7.95) (29.24)
None	316	81.02

Figures in parenthesis indicate percentage out of those families who felt the use of heat and smoke.

To elucidate information on the extent to which families, especially main cooks, found utility for smoke and heat emitted from TRC, the respondents were interrogated. It was observed that very few respondents reported uses of smoke and heat implying that the majority of the main cooks were cognizing nuisance value of the same. However the most quoted utility value of heat from TRC was its potential to keep insects away and smoke was its potential to preserve foods and keep insects away (Table 39). Villagewise analysis revealed that the proportions of main cooks from Kanjari and Sindhrot reporting utility for heat and smoke were greater than that of Vadadla. Preserving thatch, roof and food were the main uses of smoke reported by nearly one-third of families in Sindhrot. However, to 24 per cent families in Kanjari, the main purpose of smoke was to keep away insects (Appendix IV : Table 51).

The observation of the present study agrees well with that of Bussmann (1984) who reported that there was a belief among rural women that smoke was good for the house as a preventive measure of mosquitoes and other insects settling in the thatched roofs and to preserve food, dry fuelwood and seeds.

14.7 Problems with TRC

TRC of shielded `horse-shoe' shape, unless well tended while in operation, is likely to burn inefficiently due to incomplete combustion. To ascertain whether the users of TRC associated any negative attributes to TRC and its use, they were interrogated in the course of the interviews. The problems reported in declining

order were `excessive smoke' (81 per cent), `eye irritation' (78 per cent), `soot deposition on walls' (71 per cent), `running nose' (57 per cent) and `soot deposition on pots' (56 per cent). The problems less quoted by respondents were, `cough' (35 per cent) and `high fuel consumption' (31 per cent) (Table 40).

Table 40: Distribution of Families by Problems with TRC

Problems	N	%
Too much smoke	317	81.28
Eye irritation	304	77.95
Soot on walls	278	71.28
Running nose	224	57.44
Soot on pots	220	56.41
Cough	138	35.38
More fuel consumption	122	31.28
Headaches	84	21.54
Giddiness	43	11.02
Constant attention	30	7.69
Difficulty in cleaning pots	26	6.67

Total exceeds cent per cent due to multiple response

Villagewise analysis revealed that majority of the families in Kanjari and Sindhrot as compared to that of Vadadla reported too much smoke, eye irritation, soot on walls, soot on pots and running nose as the problems with TRC (Appendix IV : Table 52). The findings of the present study substantiate the fact that the women are becoming increasingly aware of the negative attributes of TRC which could be due to the publicity given to improved cookstoves.

SECTION II

Data regarding source of information about MC, factors that motivated the respondents and their families to become beneficiaries under NPIC, quality of installation of MC, participation of beneficiary families and main cooks in NPIC, present status of MC, its period of use, replacement of TRC by MC, measures taken/to be taken to repair and maintain MC and extent of use of MC were procured through the interview schedule. The relevant findings are summarised in the ensuing pages.

15.0 Source of Information about MC

The findings on families' awareness regarding various improved cooking technologies (ICTs) prior to possessing MC showed that only 22 per cent families knew about ICTs like solar cooker (13 per cent), biogas units (6 per cent) and improved chulhas (3 per cent). About 73 and 42 per cents of those who were aware of biogas units and solar cookers respectively felt it was useful to conserve biomass. In the case of IC, none of those who were aware of it, felt its uility in the context of energy crisis. Sarpanch, neighbours, friends and relatives were the sources of information on ICTs (Appendix IV : Table 53). This obviously meant that in spite of NPIC being 8 to 9 years at the time of the present study, the messages on IC were yet to reach rural families.

Publicity and awareness generation are important functions of agencies involved in transfer of technology. To gain insight into the main sources of information about MC the respondents were

interrogated. To nearly one-third of them each personnel from government and voluntary agencies that implemented NPIC in their villages were the main sources of information about MC. A little less than one-third (30 per cent) of the families received information through government sponsored agencies like TBSU that promote IC and extend technical guidance to different implementing bodies (Table 41). Relatives and neighbours were other sources to a negligible proportion of families. It emerges from the study that implementing bodies publicised NPIC around the time of installation of ICs as nearly all the families in the three villages under study came to know about MC through government agency or voluntary organisation which implemented the scheme in that village (Appendix IV : Table 54).

Table 41: Distribution of Families by Source of Information about MC

Source	N	%
Relatives	11	2.82
Govt. sponsored agencies (TBS unit)	117	30.00
Neighbours	6	1.54
Govt.office network	130	33.33
Voluntary agencies	126	32.31
Total	390	100.00

Bussmann (1984) reported that a voluntary organization was the most used channel for communicating the information concerning IC.

16.0 Factors that Motivated Families to Become Beneficiaries of NPIC

The respondents furnished information on the factors that motivated their families to become beneficiaries of NPIC under which they got MC installed. `Smokelessness' was the major motivating factor to adopt MC in 80 per cent of the families.

Table 42: Distribution of Families by Factors Motivated to Become Beneficiaries of NPIC

Reasons	N	%
Smokelessness	313	80.26
Reduction in drudgery	227	58.20
Novelty	209	53.59
Fuelsaving aspect	208	53.33
Others interest in MC	115	29.49
Material of MC	67	17.18
Subsidy/low cost	67	17.18
To be one of the first to own	53	13.59
Effectiveness of MC	47	12.05

Total exceeds cent per cent due to multiple response

`Reduction in drudgery' was another reason that motivated 58 per cent. An equal percentage of families (53 per cent) were motivated by its `novelty' and `fuel saving' aspect. The other factors that motivated families to become beneficiaries under NPIC were `others' interest in MC' (29.49 per cent), `material of

MC' (17 per cent), `subsidy/low cost' (17 per cent), `to be one of the first to own' (14 per cent) and `effectiveness of chulha' (12 per cent) in declining order (Table 42). Villagewise findings revealed that a combination of `smokelessness', `reduction in drudgery' and `fuel saving aspect' were the major motivating factors for majority of the families in Kanjari and Vadadla, while `novelty' and `smokelessness' were the main motivating factors for majority of beneficiary families in Sindhrot (Appendix IV : Table 55).

17.0 Decision Maker to Volunteer to Own MC

The majority of respondents (69 per cent) reported that a `joint decision' was taken by both the spouses in their families with reference to owning MC under NPIC. However, in one-sixth of the families, the husband was the decision maker while in one-

Table 43: Distribution of Families by Decision maker to Volunteer to Own MC

Decision maker	N	%
Husband and self	269	68.97
Husband	58	14.87
Self	43	11.02
Son	9	2.31
Father	8	2.05
Brother	3	0.77
Total	390	100.00

ninth of the families it was the main cook-the counterpart of the husband who took the decision to own MC. In a negligible proportion of families other male members like son, father and brother of main cook, were decision makers about owning MC under NPIC (Table 43). Villagewise analysis revealed that the findings were comparable in all the three villages (Appendix IV : Table 56). The findings tallied well with that of Bussmann (1984), who also observed that the building of new stove, necessitated joint decision between husband and wife.

18.0 Reasons for Delayed Installation of MC

While looking at the location of MC in the respective beneficiary family housing, data on the time taken to install the chulha completely was gathered along with reasons for delay if any occured in installation. The analysis showed that only in 54 per cent of the cases MC was installed promptly, i.e., within 2 to 3 days after the first contact by SEW/chulha maker with the beneficiary family. In the rest of the cases there was a time lapse ranging from 4 days to 6 months between the first visit and complete installation of MC. The reasons for the delay when analysed revealed that both beneficiary family centred and chulha maker/SEW centred reasons contributed to late installations of chulha (Table 44). Villagewise analysis showed that Sindhrot was better in prompt installation of MC than the other two villages. Beneficiary centred reasons were the most prominent in Vadadla as compared to Sindhrot and Kanjari where chulhamaker centred reasons prevailed over the beneficiary family centred ones for delayed installation (Appendix IV : Table 57).

Table 44: Distribution of Families by Reasons for Delay in Installation

Reasons	N	%
Failure of chulha maker to turn up	80	20.51
Raw materials not ready	64	16.41
Non availability of any one at residence	34	8.72
Lack of beneficiary cooperation	1	0.26
NA	211	54.10
Total	390	100.00

19.0 Location of MC

The performance of chulha depends to some extent upon the place from where it is operated in the house. Majority of the families (53 per cent) lived in two room housing units while 26 per cent lived in single room units (Appendix IV : Table 32). One of the guidelines of implementation of NPIC states that improved chulha of fixed type with chimney should be installed inside the house, i.e., in an enclosed area. The findings revealed that in nearly all the cases studied except 3 per cent, MC was installed in an enclosed area, kitchen being the room in those housing units that had a separate kitchen. Amongst those families where MC was installed outside, roofed verandah adjacent to kitchen was the most common area for its location. With reference to TRC it was observed that nearly 15 per cent of the families cooked either in the verandah or backyard (Table 37). Villagewise

analysis revealed that all families in Sindhrot had MC inside while a small proportion of families of Kanjari and Vadadla had MC outside either in the back verandah or yard (Appendix IV : Table 58). The improved stove must fit the existing conditions and should be placed in relation to window and door openings, since it has an impact on indoor climate through the emission of smoke, vapour and odours produced when cooking (Nystrom, 1992).

Table 45: Distribution of Families by Location of MC

Location	N	%
Enclosed area	379	97.18
Verandah with roof and low parapet wall	10	2.56
Open verandah	1	0.26
Total	390	100.00

NCAER (1993) in the evaluation survey of NPIC found that over 70 per cent households located their ICs indoors whereas 23.2 per cent were operating their chulhas from verandah. The proportion of working IC in verandah was found to be significantly lower than kitchen. The beneficiary families of the present study in majority (97 per cent) had MCs indoors.

20.0 Changes made in Cooking and Fuel Management

An improved chulha like MC with a flue duct system automatically maintains draft once the fire is built and therefore requires little manipulation in supplying fresh airflow

into the firechamber. The thermal mass of MC is much more than that of TRC because of which stored heat is more in an MC than in a TRC under stabilised conditions of operation. The fuelfeed rate could therefore be reduced considerably to maintain simmering once food reaches boiling point. In other words, the turn down ratio is high in a closed type fixed chulha like MC. By the time users of MC become adept at cooking at this improved chulha, they would have made shifts in their cooking and fuel management practices to suit prudent operation of MC. The respondents furnished data on the changes made in their cooking and fuel management practices with the change in stove. About 82 per cent respondents reported changes in cooking practices while 46 per cent reported changes in fuel management practices. The most prominent change in cooking management was observed in utilising heat from one fire for two pots in MC in contrast to one pot cooking on TRC. The next most reported change in cooking management was with reference to `attention' required in cooking. About 77 per cent of the total respondents, i.e., 94 per cent of those who changed cooking practice, reported that MC required less of their alertness or attention while food was being cooked as the stove could be controlled to cook without `boiling over' or `scorching food' by virtue of its high turndown ratio. Other changes made by more or smaller though equal proportion of families each included `reduction in size of rotla' and `less stirring' (Table 46).

Fuel management is imperative to make efficient use of depleting biomass and to maximise fuel saving potential of MC.

About 30 per cent of main cooks, i.e., of those who changed fuel management practices, effected `reduction in blowing to supply secondary air' as they found that burning continued unhampered in MC once the fire was built.

About one-fourth of those who improved fuel management practices (i.e., 10 per cent of the total sample) changed the size of fuel from large logs in TRC to small thinly chopped dry ones in MC. Change in fuel feeding rate was made by about one-fifth of them and they fed less fuel in MC as compared to TRC. A small proportion started controlling fire by reducing fuel feed rate once contents in cooking pots reached boiling point (Table 46). Changes in cooking and fuel management practices to suit efficient operation of stove was observed in more families in Sindhrot than in the other two villages (Appendix IV : Table 59).

Table 46: Distribution of Families by Changes Made in Cooking and Fuel Management Practices

Changes	N (N=319)	%
Cooking management		
Use 2 pot holes simultaneously	302	77.43 (94.67)
Less attention to tend fire	75	19.23 (23.51)
Less stirring	13	3.33 (4.08)
Make smaller rotlas	13	3.33 (4.08)
Reduce cooking medium	2	0.51 (0.63)
No change	71	18.20
Fuel mangement	(N=178)	
Less blowing to keep fire burning	118	30.26 (66.29)
Use dry fuel in small pieces	45	11.54 (25.28)
Feed less fuel	39	10.00 (21.90)
Reduce burning rate once BP reached	5	1.28 (2.81)
Avoid fuel burning outside firebox	1	0.26 (0.56)
No change	212	54.36

Figures in parenthesis indicate percentage out of those families who made changes in their cooking and fuel management practices.

21.0 Changes Made in MC

The MCs were examined to assess whether beneficiaries made any changes in the design. It was found that nearly 90 per cent families made no changes in chulha design while 10 per cent made changes. Further probe into the data was done to ascertain the kind of changes made. The commonest alterations made by more or less the same proportion-6 per cent-were removal of chimney and widening of fuelfeed (inlet) opening. The chimney was removed and

Table 47: Distribution of Families by Changes made in Chulha

Changes	N	%
Chimney removed & kept aside	23	5.90 (56.10)
Feeding chamber widened	20	5.13 (48.78)
Nails fixed on interior side	1	0.26 (2.44)
Mounds made on top surface	1	0.26 (2.44)
2nd pothole changed to firebox	1	0.26 (2.44)
2nd pothole filled with mud	1	0.26 (2.44)
Converted into TRC	1	0.26 (2.44)
NA	349	89.49

Figures in parentheses indicate percentage out of those families who made changes in MC.

kept outside due to water leakage as no sealing between pipe and roof was done by chulha makers. Changes like fixing nails on interior walls of fire chamber, making mounds on top surface, changing second pot hole into firebox and closing second pothole were made by a negligible proportion of families who owned mud MC (Table 47). It became obvious that there are more chances of tampering with dimensions of an MC in mud than in ceramic liners as most of the chulhas in which alterations were made belonged to Kanjari where only mud chulhas were installed (Appendix IV : Table 60). George and Vingle (1990) observed that 35 per cent beneficiaries made changes in their improved mud chulhas as against 10 per cent of the present study. NCAER (1993) observed that only 8.47 per cent of the households reported to have carried out changes in the chulha after installation and these included widening of feeding chamber, change in pothole size, changes in damper and changes in chimney.

22.0 Care and Maintenance of MC

22.1 Frequency of Cleaning Chimney Pipe

It is important to periodically remove the soot deposits in chimney to maintain stove efficiency. It is needless to mention that users are to be informed about the same through UEC which is an integral component of implementation strategy of NPIC. However only a negligible proportion of users of MC were observed to clean chimney pipe. Out of those who cleaned it, majority were seen to be doing so once in six to twelve months while nearly one-third of them cleaned it once in two months (Table 48).

Table 48: Distribution of Families by Frequency of Cleaning Chimney Pipe

Frequency	N	%
Never	322	82.56
Once a month	4	1.02
Once in 2 months	19	4.87
Once in 3-5 months	11	2.82
Once in 6-12 months	34	8.72
Total	390	99.99

Villagewise analysis revealed that relatively less proportion of families cleaned chimney pipe, though the proportion was not an encouraging figure (Appendix IV : Table 61). George and Vingle (1990) reported that the few (14.28 per cent) who cleaned chimney, did so once in 3 months. NCAER (1993) revealed that about 80 per cent of the fixed IC owners reported cleaning of their chimney. The proportion of working chulha where chimney is cleaned was found to be significantly more than those who did not clean. Similarly in the present study too, it was observed that the proportion of working MCs was higher in Sindhrot where the proportion of those who cleaned chimney pipe was also higher than the other two villages.

22.2 Frequency of Repair and Maintenance of Potholes of MC

In regard to repair and maintenance of potholes of MC, 43 per cent respondents reported that their families never attended

to any repair work on MC while more or less an equal proportion (17 per cent) each repaired it once in six months and once in two months respectively (Table 49). Villagewise analysis revealed

Table 49: Distribution of Families by Frequency of Repair and Maintenance of Potholes

Frequency	N	%
Once in a month	61	15.64
Once in 2 months	34	8.72
Once in 3 months	16	4.10
Once in 4 months	65	16.67
Once in 6 months	35	8.97
When crack appears	13	3.33
NA	166	42.56
Total	390	99.99

that out of those who repaired the chulha, majority in Sindhrot were seen to be doing so once in six months. Only 18 per cent of the beneficiary families in Sindhrot did not attend to repair and maintenance of MC while this observation was true with majority of the sample from Kanjari and Vadadla. The few who attended to repair and maintenance in Kanjari and Vadadla did so once in two months or once in three months (Appendix IV : Table 62). This observation could be attributed to the fact that the LQIMC in Kanjari was very poor that it demotivated its users to maintain their MCs. In Vadadla the stove was inappropriate to users' cooking needs which might have demotivated them from taking care

of MCs. On the contrary in Sindhrot, MCs were well received by its beneficiaries and they might have been motivated to a greater extent and committed to use MCs for a long time that they in large numbers (82 per cent) took care of MCs. Moreover the trend in their repair and maintenance revealed that with the passage of time, it became more intense which supports their inclination to sustain MCs as long as they could in spite of hairline crack/s that developed in liners. George and Vingle (1990) reported that 65 per cent never made any repair work on the chulha while 35 per cent repaired it one or more times in the course of 2 years.

23.0 Follow-up of MC

MC is an improved cookstove which differs from TRC. Followup is an essential tool to assist users to get accustomed to the new technology and overcome any problems related to its use, care and maintenance. The respondents reported on the frequency of visits made by chulhamaker (SEW) after installation of MC. The proportion of respondents reporting `no visit by SEW after installation of MC' was very high, the same revealing an increase with the passage of time. In nearly 50 per cent cases SEW visited `once' in the first or second or third month after installation with the corresponding proportion dropping to one-third for their visits in subsequent months after installation. SEW's visit more than once was a rare phenomenon (Table 50). Villagewise analysis revealed that the majority that reported follow up visits of SEW belonged to Sindhrot. The grassroot level chulhamaker of Vadadla was observed to have made the least

efforts in follow up while that of Kanjari was marginally better in follow up visits during the first three months after installation of MC as compaared to that of the former village (Appendix IV : Table 63).

Table 50: Distribution of Families by Follow-up

Visits	1st month		2nd & 3rd month		4th-6th month		After 6 months	
	N	%	N	%	N	%	N	%
No visit	193	49.49	204	52.31	258	66.15	269	68.97
Once	175	44.87	182	46.67	129	33.08	120	30.77
Twice	20	5.13	1	0.26	3	0.77	1	0.26
> 2 times	2	0.51	3	0.77	-	-	-	-

24.0 Reasons for Satisfaction

Nearly 52 per cent of the sample reported that they were satisfied with MC. The factors that contributed to their satisfaction were explored. About 45 per cent of them reported 'less smoke in kitchen' due to IC, one-third -'fuel saving in cooking', a little over one-fourth each-`time saving' and `ease in tending fire', and one-fifth-`comfort in cooking' as aspects of MC that made them feel satisfied. Indirect attributes like `cleaner walls' and`cleaner pots' due to less soot deposition `less heat around stove', and `less accident hazards' were quoted by very small proportions of respondents (Table 51). Villagewise analysis showed that majority of the respondents (80 per cent) from Sindhrot reported satisfaction with MC and they were cognizant of the direct as well as indirect attributes of

using MC in large proportions as compared to those from village Vadadla and Kanjari (Appendix IV : Table 64).

Table 51: Distribution of Families by Reasons for Satisfaction in Using MC

Reasons	N	%
Smokelessness	175	44.87 (87.06)
Fuel saving	130	33.33 (64.68)
Ease in tending fire	109	27.95 (54.23)
Time saving	102	26.15 (50.75)
Comfort in cooking	77	19.74 (38.31)
Cleaner walls	29	7.43 (14.43)
Cleaner pots	16	4.10 (7.96)
Less heat around stove	16	4.10 (7.96)
Less accident hazard	6	1.54 (2.99)
NA	189	48.46

Figures in parentheses indicate percentage out of those families who felt satisfied in using MC.

Sarin (1985) reported substantial fuel savings, smokelessness, decrease in cooking time, less scrubbing of utensils, little blowing, infrequent attention and increase in cleanliness of the house. George and Vingle (1990) revealed that majority of

the respondents were satisfied with IC due to `less smoke in kitchen' and `appearance of IC'and less quoted reasons were `2 pothole and one fire concept', `safety', `durability of IC', `fuel conservation' and `ease in tending fire'. NCAER (1993) observed that majority of the respondents expressed their satisfaction with reference to reduced fuel consumption (90 per cent), saving in time on cooking/cleaning of utensils (95 per cent), saving in time on collection of fuels (80 per cent), reduction in the incidence of eye diseases (63.6 per cent), reduction in the incidence of lung diseases (62 per cent) and smoke elimination (35 per cent).

25.0 Reasons for Dissatisfaction

Nearly 41 per cent of the beneficiaries expressed their dissatisfaction and these beneficiaries (87 per cent) belonged to Vadadla and Kanjari. The reasons for their dissatisfaction on analysis revealed multiple factors. While `small fire box seat' emerged as the most commonly reported reason for dissatisfaction by 24 per cent, `more fuel consumption' was reported by 18 per cent beneficiaries under study. Less quoted reasons included `failure of stove to cook anything on second pot', `backflow and smoke in kitchen', `inappropriateness', `inconvenient to operate', `small fuelfeed inlet', `insufficient knowledge to operate stove', `water leakage', and `breakage' due to poor quality of stove material in declining order (Table 52).

Villagewise scrutiny showed that only 15 per cent beneficiaries were dissatisfied with MC in Sindhrot against 53

per cent each in Vadadla and Kanjari. The two major reasons for dissatisfaction expressed by more or less an equal proportion of families (34 per cent) in Kanjari and Vadadla were `small firebox

Table 52: Distribution of Families by Reasons for Dissatisfaction

Reasons	N	%
Small firebox seat	93	23.85 (58.86)
More fuel consumption	71	18.21 (44.94)
Backflow & smoke in kitchen	38	9.74 (24.05)
Inconvenient to operate	35	8.97 (22.15)
Second pot fails to cook	30	7.69 (18.99)
Inappropriateness of MC	25	6.41 (15.82)
Small fuelfeed opening	12	3.08 (7.59)
No saving in time	10	2.56 (6.33)
Insufficient knowledge to operate MC	8	2.05 (5.06)
Large pothole	2	0.51 (1.27)
Breakage	2	0.51 (1.27)
Water leakage	1	0.26 (0.63)
NA	232	59.49

Figures in parentheses indicate percentage out of those families who felt dissatisfied.

seat' and `more fuel consumption'. The former problem was due to promotion of smaller version of MC in Vadadla and the latter was mainly due to lack of training in using MC and reluctance to change traditional cooking habits in both the villages (Appendix IV : Table 65). Bussmann (1984) observed that `not providing light' and `not warming the house' were the disadvantages felt by the owners of IC. George and Vingle (1990) found that `difficulty to feed fuelwood', `difficulty to light' and `small stove mouth' were the major problems felt in using IC (KVIC model). NCAER (1993) revealed that `more consumption of fuel', `more time to cook', `smoke emission' were the major reasons for dissatisfaction. The other reasons stated were `small feeding chamber', `pothole size not suitable', `poor quality of pipe', and `chimney sealing not proper'.

26.0 Utilisation of Time Saved due to MC

MC by virtue of its multipot facility and higher thermal efficiency than TRC facilitates faster cooking and fuel conservation both of which would lead to saving in time otherwise would have been spent in cooking fuel cycle by main cooks and other family members. The respondents were interviewed to find out the impact of use of MC on cooking time. Nearly 26 per cent of the beneficiaries of which majority belonged to Sindhrot reported `saving in time' due to MC ranging from 30 min to 2 hrs (Table 53) . The time thus saved was utilised in `leisure and rest' and `completion of other work' by majority. Other uses reported by relatively smaller proportion of respondents included ` greater participation in subsistence farming', `child care' and

`more wage employment' (Table 53). It is evident that optimum use of MC would lead to increased output in household chores as well as greater participation in economically productive work. Villagewise scrutiny revealed similar picture with reference to trend in utilisation of time with the proportion of respondents reporting the same being the most with reference to `more leisure and rest' and `attend to other work' (Appendix IV : Table 66).

Table 53: Distribution of Families by Utilisation of Time saved due to MC

Use of time saved	N	%
Attend to other work	65	16.67 (33.85)
Attend to livestock	7	1.79 (3.65)
Greater participation in subsistence farming	17	4.36 (8.85)
More wage employment	1	0.26 (0.52)
Attend to child care	8	2.05 (4.17)
More leisure and rest	66	16.92 (34.38)
None reported	198	50.77

27.0 Level of Quality of Installation

The three villages included in the study were such that in each only one agency was involved in promotion of MC under NPIC. These were State Government (SG), Non Government Organisation

(NGO) and TBSU-NPIC, Baroda. SG promoted prefab lined small sized MCs in Vadadla, TBSU-NPIC promoted prefab lined medium size MCs in Sindhrot and NGO promoted MCs in mud in Kanjari. Prefab components were fixed either in mud or brick platform. In Kanjari MCs in mud were made using mould by a trained SEW and in Vadadla it was made by a trained SEW, while it was made by master crafts persons of TBSU and SEW in Sindhrot.

Table 54: Distribution of Families by Components of MC as per Dimension Specifications

Components	N	%
Fuelfeed inlet	280	71.79
1st pothole	280	71.79
2nd pothole	280	71.79
1st tunnel	284	72.82
2nd tunnel	284	72.82
AC Cowl	130	33.33
Ceramic cowl	260	66.67
Chimney clamping	134	34.36
Chimney sealing	139	35.64
Ash hole	387	99.23
All parts, clamping & sealing	134	34.36
All parts except clam-ing & sealing	146	37.43
Chimney through roof	386	98.97
Chimney through wall	4	1.02

Total exceeds cent per cent due to multiple response.

Nearly 37 per cent of the beneficiary families had MCs with potholes and tunnels as per dimension specifications of the design. The data on each part were analysed to assess its compliance with the specifications. It was observed that dimensions of individual parts like firebox, second pothole, fuel feed inlet and both the tunnels were as per specifications in nearly 72 per cent MCs. In nearly all MCs except four, chimneys were taken through roof. However sealing the gap between chimney and roof covering material and clamping were observed only in 139 and 134 cases respectively. Ashholes to remove the ash and soot, were observed in 99 per cent of the chulhas. Only 34 per cent MCs were found to be as per specifications in all aspects including clamping and sealing of chimney to roof while 37 per cent satisfied all specifications except chimney sealing and clamping (Table 54). TBSU (1991-92) in its monitoring survey found that the quality of work was very poor due to the use of untrained persons in the construction of ICs in mud. Use of mould was rarely seen in chulha installlations. As a result chulhas did not comply by dimension specifications. NCAER (1993) reported that the working performance of chulhas fitted with pottery/ceramic liners was distinctly better with a proportion of 0.61 compared to 0.51 of those chulhas without the liners.

Villagewise analysis revealed that all MCs in Sindhrot and Vadadla were as per dimension specifications while it was so only in one-fifth of the families that owned mud chulhas in Kanjari. The former observation could be attributed to the use of MCs with prefabliners which is a standardised product.

Asbestos cement cowl was used in cent per cent MCs in Kanjari. In a very negligible proportion of families in Kanjari and Vadadla, chimney sealing and clamping were done in MCs which reflected a weakness in its installation (Appendix IV : Table 67).

27.1 Distribution of Beneficiary Families by LQIMC Score

Quality of installation is cardinal for any type of technology-whether it is a solar cooker, biogas or improved chulha. The total score on LQIMC was arrived at in the manner described earlier in the chapter on Methodology. Twelve items were included to assess LQIMC. The possible range of scores was 12 to 24.

Table 55: Distribution of Families by LQIMC

LQIMC Score	N	%
Low	47	12.05
High & moderate	343	87.95
Total	390	100.00
Mean	19.90	
SD	3.32	

It was observed that relatively a smaller proportion (12 per cent) of families earned low LQIMC score. Nearly 88 per cent earned relatively higher LQIMC score. The mean score was found to be nearly 20 (Table 55). Further breakup of LQIMC scores

revealed that about 65 per cent of the families earned 21 to 24. Villagewise analysis revealed that those by and large beneficiaries from Sindhrot and Vadadla earned relatively higher scores as compared to those from Kanjari (Appendix IV : Table 68).

28.0 Nature and Type of Training Received

An attempt was made to probe into the type and nature of training imparted by implementing agencies for the benefit of beneficiary families. Nearly 73 per cent of respondents from beneficiary families did not report any type of training. However 15 per cent reported that they were given live demonstrations on cooking at TRC and MC to generate correct understanding of cooking and fuel management and merits of MC over TRC while 11 per cent reported that both lectures and live demonstrations were given. A small proportion of respondents reported that their families were imparted training individually as and when requested (Table 56). Bussmann (1984) revealed in his study that giving talk was the most frequently usd method in disseminating IC technology. Only in Sindhrot 77 per cent of the respondents of beneficiary families reported that they took advantage of UECs conducted - either through lecture or demonstration or both. In Kanjari and Vadadla cent per cent and 98 per cent respondents from beneficiary families respectively reported that they were not aware of any training given under NPIC. The data revealed that the respondents from Vadadla reported only one training for the entire village. Nearly 50 per cent in Sindhrot reported that more than one training camp

was conducted in their village for separate clusters of families (Appendix IV : Table 69).

Table 56: Distribution of Families by Awareness of Type and Nature of Training Given

Training	N	%
Type		
Lecture	1	0.26
Demonstration	60	15.38
Both	44	11.28
None	285	73.08
Total	390	99.99
Nature		
One for entire village	3	0.77
One for a group of families	36	9.23
>one for a group of families	61	15.64
Individually as & when requested	5	1.28
None	285	73.08
Total	390	100.00

29.0 Extent of Participation in NPIC

29.1 Extent of Paritipation of Main cook in NPIC (EPMCNPIC)

29.1.1 Exposure of Main cooks to User Education Camps (EMCUECs)

Exposure of main cooks to user education camps was considered an important component that would contribute towards their participation in NPIC. The main cook is the family member primarily associated with cooking at MC. If main cooks have

right perspective on merits/demerits of MC, its use, care and maintenance it would influence their cooking and fuel management practices and their inclination to optimally use MC in daily cooking. UECs are aids that are provided in implementation strategy of NPIC to achieve potential users' training.

The extent of exposure of MCUEC was ascertained in terms of their presence in UECs the number of UECs attended, and whether these were attended before or after installation of MCs. The findings revealed that majority of MCs were never present throughout the camp/s conducted. While 7 per cent were present during part of the same (Table 57). Villagewise analysis showed that in Sindhrot 50 per cent of main cooks were present throughout the UECs while 20 per cent were present during part of the UEC and about 30 per cent were not at all present in any of the UECs. In contrast to this, the attendence of main cooks from the other two villages in UECs was practically nil or negligible (Appendix IV : Table 70). It was found that only a negligible proportion of main cooks (5.38 per cent) attended all UECs while 18.46 per cent attended some UECs. Villagewise analysis revealed main cooks of Sindhrot being superior to their counterparts in the other two villages in this regard. In relation to their exposure to UECs prior to and after installation of MC it was observed that 19 per cent got exposure only either prior to or after installation of MC while 4.6 per cent were exposed to UECs both prior to and after installation of MC. Villagewise analysis showed superiority of main cooks over those of the other two villages in this regard as well (Appendix IV : Table 70).

29.1.2 Presence of Main Cooks During Installation of MC

Installation of MC is quite different from that of TRC in that the final IC has to maintain certain dimension specifications and those with prefab components are to be set in platform of mud or brick in mud. Main cooks presence in installation of MC would enhance their involvement in NPIC and in turn it would help them to understand the intricacies in its installation as well as its components and its relevance. Presence of main cooks in installation of MC was included as a component that would measure their extent of participation in NPIC.

The summary of findings showed that majority (68 per cent) were present only part of the time while a little over one-fourth (30 per cent) were present throughout the period of installation of MC. On the contrary an insignificant proportion of main cooks were not at all present in the course of installation of MC (Table 57). Villagewise analysis showed that there was not much variation in the three villages regarding the presence of main cooks during installation of MC (Appendix IV : Table 70).

29.1.3 Contribution of Labour

Participation of main cook in NPIC was also measured through the contribution of labour by main cook to make MC. It was assumed that involvement of main cook in construction of MC could influence rate of adoption of MC.

Table 57: Distribution of Families by EPMCNPIC

EPMCNPIC	N	%
Camps attended		
Not at all	297	76.15
Partially	28	7.18
Through out	65	16.67
Total	390	100.00
No. of Training camps		
None	297	76.15
Some	72	18.46
All	21	5.38
Total	390	100.00
Prior to/after installation of MC		
None	297	76.15
Either before or after	75	19.23
Both before and after	18	4.62
Total	390	100.00
Presence during installation of MC		
Not present	8	2.05
Partially present	266	68.21
Through out	116	29.74
Total	390	100.00
Contribution of labour		
None	27	6.92
Reluctantly	24	6.15
Willingly	339	86.92
Total	390	100.00

The findings revealed that majority of the main cooks (86 per cent) willingly contributed their labour in installing MC, while a negligible proportion contributed their labour reluctantly after repeated requests. Nearly in 7 per cent of the families there was no labour contribution by main cook (Table 57). Villagewise findings did not reveal any variation in involvement of main cooks in installation of MCs (Appendix IV : Table 70).

29.2 Extent of Participation of Families in NPIC (EPFNPIC)

29.2.1 Exposure of Families to UECs (EFUEC)

EFUECs was measured in terms of the family member/s who attended UECs, the number of training programmes attended by the family and whether the exposure to UECs took place prior to or after installation of MC.

The findings related to EFUEC revealed that 27 per cent of them attended training camps while the majority did not attend any training camp under NPIC (Table 58). About one-fifth of the beneficiary families attended UECs either before or after installation of MCs. A small proportion (6 per cent) attended UECs both before and after installation of MCs.

Table 58: Distribution of Families by Exposure to UECs

Exposure to UECs	N	%
Participant		
Cooks/women	90	23.08
Men	2	0.51
Female children	23	5.89
Male children	10	2.56
No. of UECs Attended		
None	285	73.08
One	51	13.08
Two	37	9.49
Three	17	4.36
Total	390	100.00
UECs attended		
None	285	73.08
Either before or after MC installation	81	20.77
Both before and after MC installation	24	6.15
Total	390	100.00

Total exceeds cent per cent due to multiple response

Further scrutiny of the data on participation in UECs revealed that main cooks/women attended the same in 23 per cent families. In a small proportion of families men and children too attended UECs (Table 58). About 73 per cent of the families in Sindhrot participated in UECs. On the other hand only 2 per cent families from Vadadla revealed similar finding.

The proportion of families that were exposed to more than one UEC decreased as the number of UECs increased. In other words, against 13 per cent who were exposed to one UEC, only 4 per cent were exposed to three UECs (Table 58). Villagewise data showed that more families in Sindhrot were exposed to more UECs than those in the other two villages (Appendix IV : Table 71).

In Vadadla and Sindhrot 2 per cent and 60 per cent of the families respectively participated in UECs either before or after installation of MC. However 18 per cent of the families in Sindhrot attended UECs, both before and after installation of MC. About 21 per cent families attended none of the UECs camps in Sindhrot while the same was true in 98 per cent and cent per cent families of Vadadla and Kanjari respectively (Appendix IV : Table 71).

NCAER (1993) revealed that only about 45 per cent of the owners have undergone training on how to use chulha. A significant improvement in the proportion of working IC in households who have undergone training on use of chulha and repair and maintenance was observed as against untrained households.

29.2.2 Presence of Family members during Installation of MC

Presence of family members during installation of MC would indicate their interest and curiosity in NPIC and it would also reveal to them the detaching in installation of MC.

Table 59: Distribution of Families by Their Presence and Contribution towards Installation of MC

Details	N	%
Presence		
Nobody	1	0.26
Any member other than Cook	7	1.79
Only main cook	116	29.74
Main cook & other member/s	266	68.20
Total	390	100.00
Material contribution		
None	1	0.26
Mud & dung	259	66.41
Brick,mud & dung	130	33.33
Total	130	100.00
Monetary contribution (Rs.)		
None	3	0.77
Five	5	1.28
Ten	132	33.85
Fifteen	250	64.10
Total	390	100.00
Labour contribution		
None	27	6.92
Family's with requests	24	6.15
Only cook's voluntarily	197	50.51
Cook's & family's voluntarily	142	36.41
Total	390	99.99

It was found that cook and other family members were present in 68 per cent families during installation of MC. In a little less than one-third of the families cook alone was present when MC was installed. Other family members other than the cook were present during installation in a negligible proportion (2 per cent) (Table 59).

The contribution of families in the form of material, money and labour were also parameters used as sub components of the measure of their participation in NPIC. Families' interest and enthusiasm in contributing these could influence adoption rate.

Sixtysix per cent of the families contributed mud and dung for MC installation and 33 per cent contributed brick, mud and dung. Only in one family chulhamaker himself had procured the necessary materials for installation of MC (Table 59).

In half of the families, main cook emerged as the only family member who contributed labour voluntarily in installing. Cook and other family member/s were involved in installation in a little more than one-third of the families. Nearly in 7 per cent of the families there was no labour contribution by any of the family members. Not much variation was observed when data in this regard were analysed by village (Appendix IV : Table 72).

About 64 per cent of the families paid Rs.15.00 towards cost sharing of MC. While one-third of the families paid Rs.10.00, a very small percentage of families paid Rs.5.00 per chulha. In three families chulhas were installed free of cost (Table 59).

Villagewise findings did not reveal any particular trend that was comparable in all the three villages (Appendix IV : Table 72).

29.3 Extent of Participation of Main Cooks and Families in National Programme on Improved Chulha (EPMCNPIC and EPFNPIC)

It was assumed that participation of beneficiary families in NPIC would influence adoption rate of MCs. The various aspects that were included in the present study as a measure of participation were same as those aspects considered for cost sharing and EPMCNPIC and material and money contribution in installation of MCs.

The possible score of EPMCNPIC and EPFNPIC ranged from 7 to 28. The mean score on EPFNPIC was computed to be 17.64 with an SD of 3.62. Nearly one-fourth of the families were high scorers with reference to EPFNPIC, with 71 per cent families earning moderate score and the remaining earning relatively low score (Table 60). Further analysis revealed that nearly one-third each earned EPFNPIC scores ranging from 10 to 13 or 14 to 17. Approximately one-fifth earned EPFNPIC scores 22 or more while approximately 10 per cent earned 18 to 21. Villagewise analysis showed that half of the families in Sindhrot earned scores ranging from 22 or more while majority of the families in Kanjari and Vadadla earned scores ranging from 10 to 13 and 14 to 17 respectively (Appendix IV : Table 73).

The main cooks were also categorised by their EPNPIC. The findings revealed that one-fourth belonged to category `high'. The moderate and low scorers were combined as only a nominal

proportion of cooks fell in the low category. Thus 77 per cent belonged to moderate category (Table 60). The mean EPMCNPIC was 10.73. Further analysis revealed that nearly one-third each earned EPMCNPIC scores ranging from 5 to 8 or 13 to 15. A little less than one-fourth earned EPMC scores 9 to 12. Villagewise analysis showed that majority of the families in Kanjari earned scores ranging from 5 to 8, more or less an equal proportion (40 per cent) in Vadadla earned scores ranging from 5 to 8 and 9 to 12 respectively. While majority of the families in Sindhrot earned EPMCNPIC scores ranging from 13 to 15 (Appendix IV : Table 63).

Table 60: Distribution of Families by EPFNPIC and EPMCNPIC Score

Category	EPFNPIC		EPMCNPIC	
	N	%	N	%
Moderate	277	71.03	300	76.92
Low	22	5.64	-	-
High	91	23.33	90	23.08
Total	390	100.00	390	100.00
Mean	17.64		10.73	
SD	3.62		3.82	

30.0 Extent of Adoption of MC (EAMC)

EAMC was measured in terms of replacement of TRC by MC, use of TRC in pre and post installation period of MC, variety in cook stoves used, extent of use of MC, period of continued use of MC,

functional status of MC, measures taken/to be taken when MC cracked or liners broke and its recommendation to others. The findings pertinent to these aspects are summarised in Tables 61 to 69.

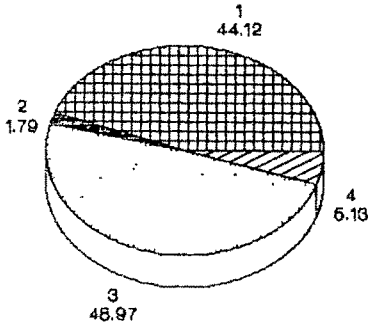
30.1 Replacement of TRC by MC

Replacement of TRC by MC at the time of the study was ascertained as a measure of adoption of MC in daily cooking. It was found that after installation of MC, nearly half of the beneficiary families completely switched over to MC for carrying out different cooking tasks. Nearly 44 per cent abstained from using MC due to one reason or other after adoption. A very negligible proportion used more extensively TRC than MC (Table 61). About 75 per cent in Sindhrot had completely switched over to MC. However majority of the families in Vadadla and Kanjari used only TRC after the installation of MC (Appendix IV : Table 74).

Table 61: Distribution of Families by Replacement of TRC by MC

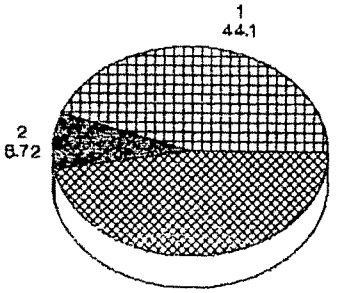
Extent of Replacement	N	%
TRC not replaced at all	172	44.12
TRC replaced by MC	20	5.13
Equal use of both TRC & MC	7	1.79
TRC replaced to a great extent/ total replacement	191	48.97
Total	390	100.00

Fig. 2 Distribution of Families by Replacement of TRC by MC



1 TRC not replaced at all
2. Equal use of both TRC & MC
3 TRC replaced to a greater extent
4 TRC replaced by MC

Fig. 3 Distribution of Families by Comparative Use of TRC in Pre and Post Installation of MC



1 Same
2 Reduced Use
3 Not in Use at all

30.2 Comparative Use of TRC in Pre and Post Installation Period of MC

A comparison in the extent use of TRC in pre and post installation period of MC was carried out as an indirect indicator to assess adoption of MC. Nearly 47 per cent of the families were not using TRC at all after the installation of MC. The usage of TRC was same in post installation period as in pre-installation period of MC in 44 per cent families (Table 62). Majority of the families in Vadadla and Kanjari used TRC to the same extent in pre and post instllation period of MC. However in Sindhrot 75 per cent of the families stopped using TRC after the installation of MC (Appendix IV : Table 75).

Table 62: Distribution of Families by Comparative Use of TRC in Pre and Post Installation of MC

Use of TRC	N	%
Increased use	-	-
Same	172	44.10
Reduced use	34	8.72
Not in use at all	184	47.18
Total	390	100.00

30.3 Variety in Cookstoves used During Post Installation of MC

It was assumed that if families adopted MC, they would refrain from using other stoves (like kerosene) other than MC, for cooking purpose. Hence information was sought regarding the variety of cookstoves used during post installation of MC.

Table 63: Distribution of Families by Variety in Cookstoves Used During Post Installation of MC

Stoves	N	%
Only MC	184	47.18
MC with one other stove	17	13.08
MC with two other stoves	10	2.56
No MC at all	172	44.12
Total	390	100.00

Nearly 47 per cent were using MC alone for cooking purposes during post installation of MC. The usage of MC with one or two other stoves was observed in a small proportion of families while other stoves other than MC was used for cooking in 44 per cent cases (Table 63). Majority of the families in Vadadla and Kanjari used some other stoves other than MC, while about 75 per cent of the families in Sindhrot used MC alone (Appendix IV : Table 76).

30.4 Extent of Use of MC

Extent of use of MC was calculated by taking into consideration the number of items cooked on MC out of the total number of items cooked on normal days by each family during use of MC after its installation. More or less an equal proportion used MC to the extent of < 25 per cent and 76 to 100 per cent each. Only 10 per cent used MC to the extent of 51 to 75 per cent. Thus MC was put to cooking 51 per cent or more of the items

on normal days by majority of the families (Table 64). Vadadla revealed the highest proportion of families making the lowest extent of use of MC followed by Kanjari. However in Sindhrot 66 per cent families used MC to the extent of 76 to 100 per cent for its cooking tasks (Appendix IV : Table 77).

Table 64: Distribution of Families by Extent of Use of MC

Extent of use of MC (per cent)	N	%
<-25	170	43.59
25-50	21	5.38
51-75	39	10.00
76-100	160	41.02
Total	390	99.99

30.5 Period of Continued Use of MC

Period of use was one of the parameters used to arrive at extent of adoption of MC. It was found that nearly 40 per cent beneficiary families used MC six to less than nine months. Approximately 30 per cent used MC for 9 or more months. On the other hand, more or less an equal proportion of families used MC for less than 3 months and 3 to less than 6 months respectively (Table 65). In Kanjari the maximum period of use of MCs was less than nine months but more than six months while in Vadadla the corresponding period was more than 9 months though it was observed in relatively small proportion of the families. In both Kanjari and Vadadla, majority of the families 61 and 48 per cent

respectively, used MC for more than 6 months but less than 9 months. On the other hand, in 83 per cent of the families in Sindhrot MCs were in use for more than 9 months (Appendix IV : Table 78). NCAER (1993) in its evaluation survey observed that a large proportion of chulhas installed got out of circulation within 3 months of its installation.

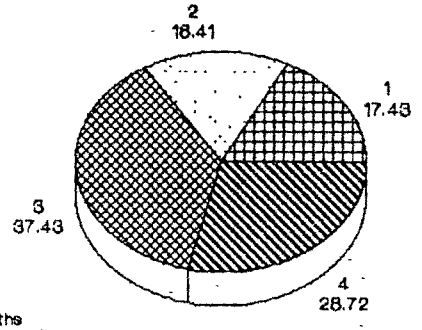
Table 65: Distribution of Families by Period of Continued Use of MC

Period of use (months)	N	%
< 3	68	17.43
3 to <6	64	16.41
6 - < 9	146	37.43
≥ 9	112	28.72
Total	390	99.99

30.6 Functional Status of Chulha

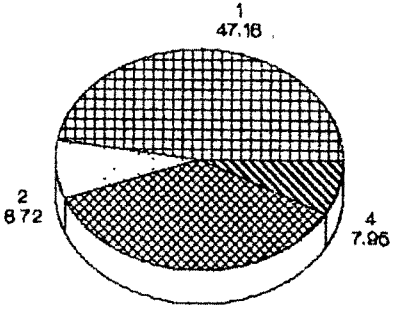
Functional status of MC was ascertained through feedback survey conducted in each of the three villages at least 8 months after installation of MC. It was observed that approximately 50 per cent of the MCs were in regular use. Nearly 9 per cent of the families used MC occassionally. However in 8 per cent of the families, though chulha was present, it was not being used at the time of survey. Further it was observed that MCs had been demolished in nearly 36 per cent of the families studied (Table 66). About 72 per cent and 45 per cent families in Sindhrot and Kanjari respectively were found using MCs regularly. An equal

Fig. 6 Distribution of Families by Period of Continued Use of MC



1. < 3 months
2. 3 to <6 months
3. 6 - <9 months
4. > 9 months

Fig. 7 Distribution of Families by Funotional Status of MC



1. Regular use
2. Occasionally used
3. Demolished
4. Not in use but present

proportion of families each (46 per cent) in Kanjari and Vadadla had demolished MCs (Appendix IV : Table 79).

Table 66: Distribution of Families by Functional Status of MC

Status of MC	N	%
Regular use	184	47.18
Occasionally used	34	8.72
Not in use but present	31	7.95
Demolished	141	36.15
Total	390	100.00

Further scrutiny of data on `demolished MCs' and `MCs not in use' was carried out. It was seen that 44 per cent of MCs were non operational in the families. Out of these MCs, in 52 per cent of the cases, beneficiary families stopped its use prior to the onset of the first monsoon after its installation while in 35 per cent, it did not survive the first monsoon. However one-tenth of the beneficiary families were observed to have stopped using MC that survived monsoon (Appendix IV : Table 79). A few studies have reported discontinuance of use of MC as a result of its damage due to rain water leaking onto it through the gap between chimney and roof covering or due to its installation in unprotected open area (TBSU Annual Report, 1989-90, and IIT Annual Report, 1989-90).

Data on reasons for discontinuing the use or demolishing MC prior to first monsoon after its installation was analysed in the

52 per cent cases. All the reasons were technology centred ones, with `failure of MC to cook rotla' being the most quoted reason (40 per cent) followed by `broken chulha' (28 per cent), `more fuel consumption' (26 per cent) and `small fuelfeed opening' (22 per cent). These reasons were most commonly reported by respondents of Vadadla. It is needless to mention here that the MCs installed in Vadadla were small in size appropriate for small families. In reference to those MCs that did not survive the first monsoon, 82 per cent respondents reported leakage of rain water onto the chulha that damaged it as the main reason for its demolition. This was the most prominent in Kanjari. The reason reported by 50 per cent of those respondents, whose MCs were discontinued after it survived the first monsoon, was the deep cracks/breakages formed in the prefab liners. `Broken chimney pipe' led to its discontinuance in 20 per cent of such families. While broken liners was reported by 8 respondents of Vadadla, `broken pipes' was reported by 3 respondents of Kanjari (Appendix IV : Table 80).

The problem of water leakage could be overcome through increasing accountability of the chulha maker and proper monitoring of the work of the SEW. On the other hand, the technology centred reasons could be overcome through proper orientation of users regarding the design and its relevance to efficiency in performance, through selection of appropriate size of MC to suit user needs and through greater involvement of beneficiaries in NPIC.

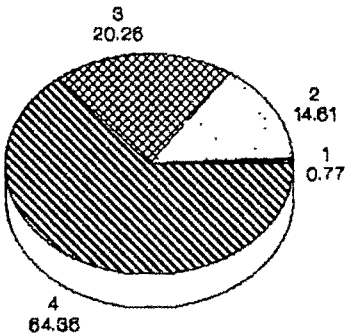
30.7 Measures Taken/to be Taken if Chulha Liners Cracked/Broke

Respondents were questioned about the measures taken/ to be taken by them if the chulha cracked or liners were broken as it was thought that this would reflect on their decision to continue or discontinue the use of MC. Nearly 64 per cent of the families reported that they would switch over to TRC (Table 67). One-fifth of them, however said that they would repair the broken pieces and refix the liner. Nearly one-seventh of the families expressed willingness to buy new liners if available. A very minute percentage of families said that they would approach the chulha maker for repair. None of the respondents reported that they would develop the skill to remake and reinstall MCs themselves (Table 67). The villagewise analysis revealed no other response other than `switch over to TRC' from beneficiaries of Kanjari while about 65 and 28 per cent of beneficiaries from Vadadla and Sindhrot respectively gave the same feedback (Appendix IV : Table 81).

Table 67: Distribution of Families by Measures Taken/to be Taken if Liners Broke

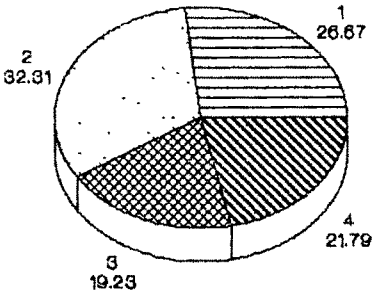
Measures taken	N	%
Approach the chulha maker	3	0.77
Buy new liner if available	57	14.61
Repair MC and use it	79	20.26
Switch over to TRC	251	64.36
Total	390	100.00

Fig. 8 Distribution of Families by Measures Taken/to be Taken if Liners Broke



1. Approach the chulha maker
2. Buy new liner if available
3. Repair MO and use it
4. Switch over to TRC

Fig. 9 Distribution of Families by Recommending MC to Other



1. Mostly
2. Sometimes
3. Rarely
4. Never

30.8 Recommendation of MC to Others

Beneficiary families are likely to recommend to others replacement of TRC by MC, if they are convinced about its utility and have accepted it as an appropriate cookstove. Hence it was thought worthwhile to find out from beneficiaries of MC their opinion in this regard.

Table 68: Distribution of Families by Recommending MC to Others

Recommended	N	%
Mostly	104	26.67
Sometimes	126	32.31
Rarely	75	19.23
Never	85	21.79
Total	390	100.00

About 27 per cent of the beneficiary families recommended the use of MC mostly to others while 32 per cent recommended its use sometimes to others. About 22 per cent never recommended the use of MC to others (Table 68). In Sindhrot 62 per cent recommended mostly the use of MC to others, while in Kanjari 46 per cent recommended only sometimes. In Vadadla majority of them either rarely or never recommended the use of MC to others (Appendix IV : Table 82).

30.9 Distribution of Families by EAMC Score

Eight parameters as above were assessed to arrive at EAMC Score. The analysis of data showed that more or less an equal

proportion of families were categorised as moderate and low adopters of MC respectively. The families had a mean adoption score of 20.18 (Table 69). About 50 per cent families had scores ranging from 26 to 31 while 40 per cent had scores ranging from 8 to 13 (Appendix IV : Table 83). Villagewise analysis revealed that the proportion of families (77 per cent) that earned scores ranging from 26 to 31 in Sindhrot was higher than that of the other two villages. This implies that families in Sindhrot revealed adoption of MC to a greater extent than that of the other two villages. This might be due to the appropriate size and material of chulha, better quality of installation, regular follow-up, greater participation of family and cook in NPIC and also, the greater perception regarding economic and non-economic benefits against the costs incurred in adopting an MC. In addition the strategy followed for dissemination was also different.

Table 69: Distribution of Families by EAMC

EAMC	N	%
Low	149	38.21
Moderate	138	35.38
High	103	26.41
Total	390	100.00
Mean	20.18	
SD	7.98	

31.0 Perceived Cost-Benefit Ratio (PCBR)

One of the objectives of the study was to assess the perceived cost-benefit ratio with reference to adoption of an improved chulha like MC. Hence a descriptive rating scale to measure perception of costs and benefits due to adoption of MC was developed. The main cooks were asked to respond to statements reflecting cost-benefit that would accrue to them by virtue of their adopting an improved chulha-Mamta Chulha-under NPIC. Each response reflecting either a benefit or a cost was ascribed a score of 3. The difference between the benefit score and cost score earned by each respondent was computed and its ratio was estimated out of the total score possible on the scale of 24 statements. The Cost-Benefit ratio ranged from -1 to +1. Using mean and SD, the total sample were categorised into high, moderate and low scorers of PCBR. While 58 per cent fell in the moderate group whose PCBR ranged from -.38 to +.66 nearly one-fourth revealed a PCBR of +0.67 or more. On the other hand, a little less than one-fifth of the sample had a low PCBR of -0.39 or less revealing an inclination towards very high perception of costs than benefits through the possession of MC (Table 70).

The over all mean PCBR of +0.14 showed that the respondents'-main cooks'- perception on benefits was only marginally better. Villagewise mean figures showed that the beneficiaries of Sindhrot earned a mean PCBR of +0.51 which was remarkably higher than that of Vadadla +0.09 and Kanjari -0.19. This observation indicated a relatively higher perception of

Fig. 10 Distribution of Families by EAMC

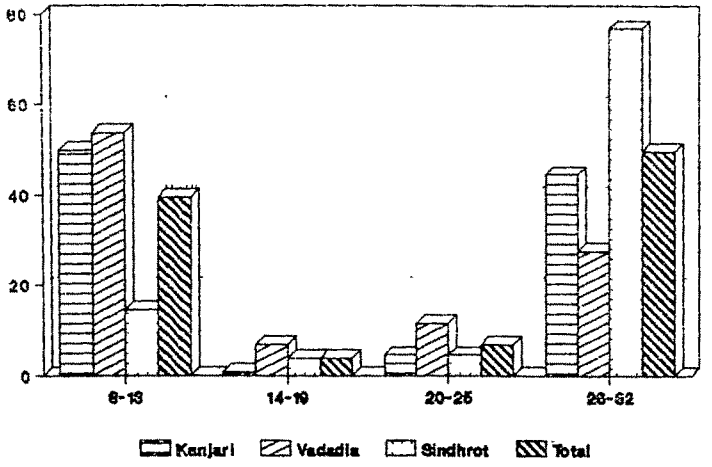


Fig. 11a Profile of Main Cooks by Adoption Scores

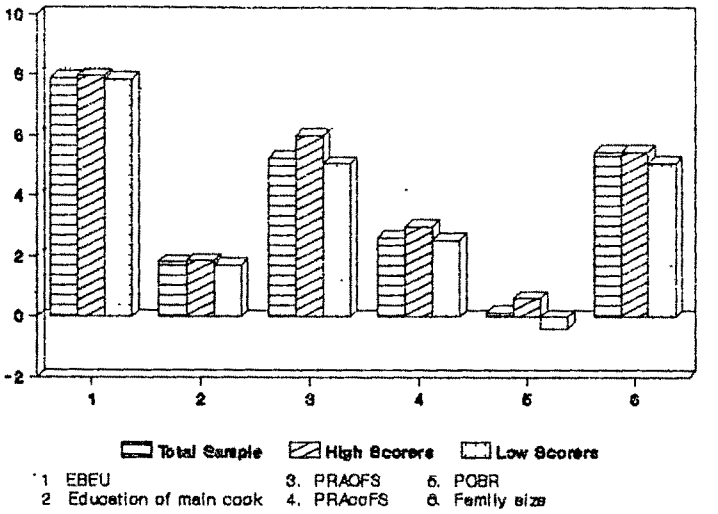


Table 70: Distribution of Families by PCBR

PCBR	N	%
Low	73	18.72
Moderate	226	57.95
High	91	23.33
Total	390	100.00
Mean	+0.14	
SD	+0.53	

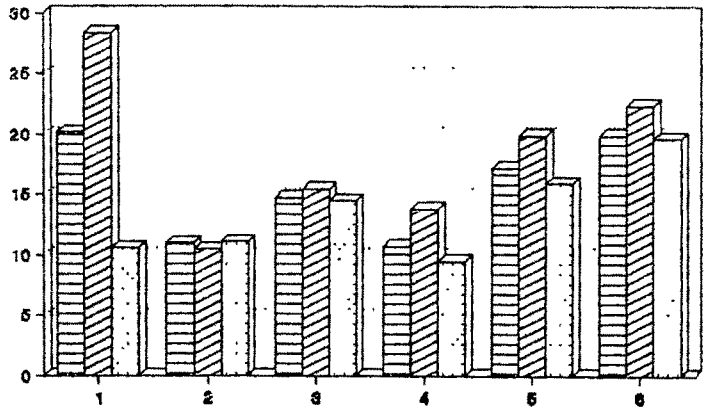
benefits of MC by its users in Sindhrot (Appendix IV : Table 84). On the other hand, the mean PCBR of -0.19 of respondents in Kanjari indicated that their perception of costs of owning or adopting an MC outweighed that of benefits.

32.0 Profiles of High and Low Adoption Scorers

Data from 105 beneficiary families each (27 per cent) who had scored low and high respectively with reference to EAMC score were examined to have an understanding about their salient characteristics.

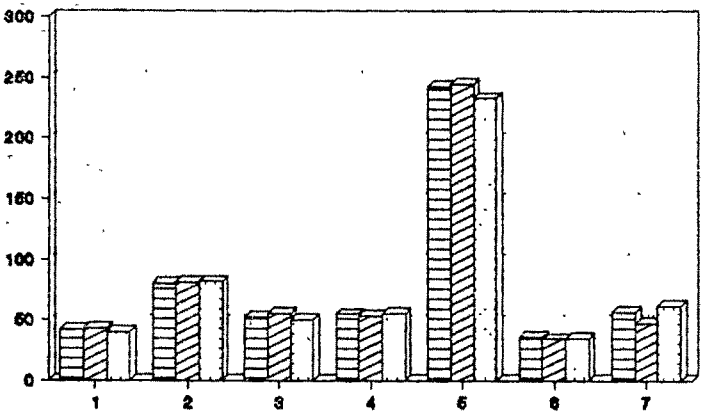
Families who scored high on EAMC in contrast to those who scored low, were characterized by relatively smaller size of landholding, higher EPCDG, better EMPF, higher PCBR, higher EPMCNPIC and EPFNPIC, better LQIMC, higher score on EAFAD, lower EIMCDS and higher EIFDS.

Fig. 11b Profile of Main Cooks by Adoption Scores



1. EAMC 3. EAFAD 5. EPFNPIC
2. LQH 4. EPMCNPIC 6. LQMC

Fig. 11c Profile of Main Cooks by Adoption Scores



1. EPODG 3. EMPF 5 EIFDS 7. Land holding
2. EDMOT 4. EIMCDS 6 Age of main cook

On the other hand, those families who were low adoption scorers, in comparison to high scorers, were characterized by relatively lower education level of the main cook, larger landholding, better LQH, lower mean score on EPCDG, poorer EMPF, lower PRACFS and PRAACFS, lower EPMCNPIC and EPFNPIC, lower PCBR, poorer LQIMC, lower score on EAFAD, slightly higher score on EIMCDS and lower EIFDS (Table 71).

However high scorers and low scorers compared well in their mean family size, age of main cook, score on EBEU, and EDMCT. The most remarkable contrast in characteristics of families with higher adoption score, was observed in EMPF, EPFNPIC and EPMCNPIC, PCBR and LQIMC. The high scorers seemed to exercise better energy management practices which could have enabled them to adopt MC to conserve biomass and learn its optimum use to a greater extent than low scorers.

Table 71: Comparison of Mean of Family Characteristics in Relation to Adoption Scores

Variables	Total sample N = 390	High scorers N = 105	Low scorers N = 105
EAMC	20.18	28.36	10.59
LQH	11.00	10.46	11.10
EPCDG	42.04	43.14	40.40
EDMCT	80.12	81.19	81.71
EBEU	7.91	7.97	7.86
EAFAD	14.73	15.46	14.49
EMPF	52.52	55.62	50.27

EIMCDS	55.02	53.46	55.58
EIFDS	242.92	244.37	232.90
EPMCNPIC	10.73	13.80	9.52
EPFNPIC	17.24	19.91	15.92
LQIMC	19.90	22.40	19.66
Age of main cook (years)	35.75	34.29	34.72
Education of main cook	1.81	1.85	1.72
PRACFS	5.26	6.00	5.07
PRAACFS	2.63	2.99	2.55
PCBR	0.14	0.63	-0.38
Family size	5.47	5.47	5.10
Landholding	56.76	47.15	61.36

They were also able to perceive the benefits of MC better than low scorers. Since quality of installation of MC of high scorers was relatively better and their exposure to UECs higher, probably they could understand merits and demerits of MC better which led to higher PCBR which in turn made them better adopters.

33.0 Profile of High and Low Scorers of PCBR

Profile of high and low scorers on PCBR was evolved using 33 per cent at the top and bottom of the list of main cooks arranged in a descending order by their PCBR. Those exhibiting high PCBR were characterized by relatively higher education level, better PRACFS and PRAACFS, higher EPMCNPIC and better LQIMC in their kitchens (Table 71.1).

Fig. 12a Profile of Main Cooks
by PCBR Scores

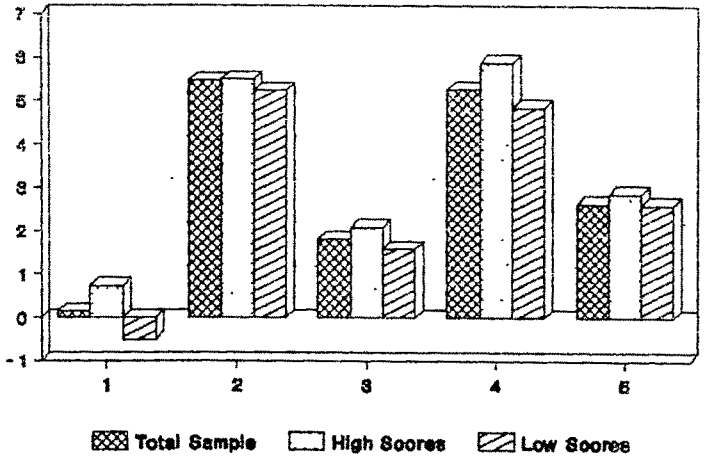


Fig. 12b Profile of Main Cooks
by PCBR Scores

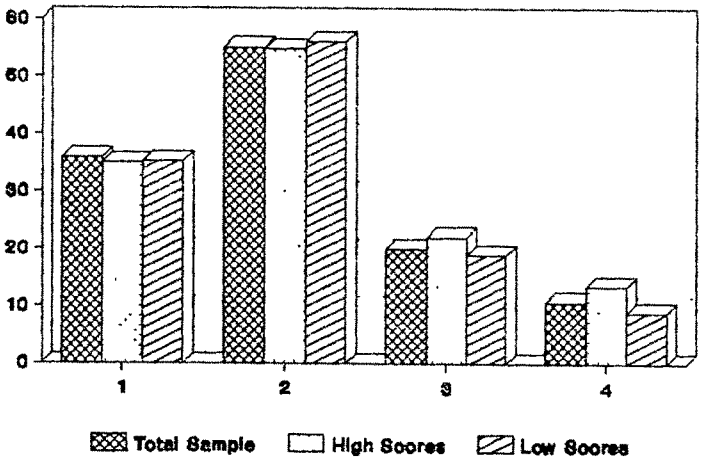


Table 71.1: Comparison of Mean of Family Characteristics in Relation to PCBR Scorers

Characteristics	Total sample N = 390	High scorers N = 130	Low scorers N = 130
PCBR	0.14	0.74	-0.50
Family size	5.47	5.50	5.23
Age of main cook	35.75	34.87	35.06
Education level of main cook	1.81	2.09	1.58
EIMCDS	55.02	54.67	55.90
PRACFS	5.26	5.89	4.85
PRAACFS	2.63	2.86	2.60
LQIMC	19.90	22.02	18.78
EPMCNPIC	10.73	13.42	8.90

In contrast to the high scorers, those who earned low PCBR were characterized by relatively lower level of education, lower PRACFS and PRAACFS, lower EPMCNPIC, and poorer LQIMC. However high scorers and low scorers compared well in their family size, age and score on EIMCDS. The most remarkable contrast in chracteristics of main cooks who are the key actors in cognizing costs and benefits of adoption of MC was observed in EPMCNPIC participation, LQIMC, education level and PRACFS. Probably with a better education level, higher exposure to NPIC and better LQIMC, high scorers could perceive more benefits than costs and thus earn higher PCBR value.

Table 72: Coefficients of Correlations for Eighteen Variables and Extent of Adotion of MC

Variables	Education	PRACFS	PRAACFS	PCER	Family size	Land holding	EMPS	EIMCDS	EIFDS	EAFAD	EBEU	LQH	EPCDG	EIMCT	EPMCNPIC	EPFNPIC	LQIMC	EAMC
Age	-.157**	-.059	-.033	.005	.010	.171**	.053	.114	.227**	-.016	.130	.082	.175**	-.311**	-.062	.018	-.096	.013
Education		.020	-.058	.094	-.067	.132**	.004	.024	.086	.194**	.079	.191**	.198**	.039	.052	.051	.185**	.011
PRACFS			.143**	.408**	-.039	-.128**	.170**	.059	.029	.332**	.012	.023	.021	.090	.535**	.494**	.795**	.198**
PRAACFS				.067	-.053	-.044	.038	-.073	-.005	.118*	.053	-.066	.014	.020	.005	.013	.079	.059
PCER					.050	.083	.354**	-.057	-.028	.205**	.104*	.028	.119*	-.021	.403**	.474**	.403**	.667**
Family size						.174**	.054	-.063	.557**	.204**	.129**	.088	.404**	-.510**	.041	.075	-.041	.055
Landholding							-.030	.169**	.382**	.132**	.616**	.326**	.493**	-.317**	-.163**	-.122*	-.054	.017
EMPS								-.060	.013	.123**	.065	-.102	-.025	-.025	.183**	.199**	.154**	.329**
EIMCDS									.211**	.101	.178**	-.056	.069	.013	-.132**	-.141*	.047	-.111*
EIFDS										.321**	.177**	.254**	.481**	-.465**	-.054	-.122*	.019	-.021
EAFAD											.113*	.174**	.337**	-.117*	.252**	.213**	.401**	.129**
EBEU												.084	.232**	-.151**	-.237**	-.130**	.036	.040
LQH													.493**	-.150*	.038	.017	.089	-.059
EPCDG														-.491**	-.044	.037	.099*	-.005
EIMCT															.002	-.073	.065	.026
EPMCNPIC																.857**	.268**	.302**
EPFNPIC																	.537**	.308**
LQIMC																		.114*
EAMC																		-

* Significant at .05 level

** Significant at .01 level

34.0 HYPOTHESES TESTING

Null hypotheses were formulated to test the hypotheses statistically. Correlation coefficients were computed for all continuous variables using data on the entire sample. Analyses of variance were computed for EAMC and the respective variables. Wherever significant `F' values were found, `t' test was applied. To ascertain the order in the influence of variables on EAMC by beneficiary families, step-wise regression analysis was carried out. In this section, the observations made in relation to testing of hypotheses are presented. First, the findings pertinent to Hypothesis I are summarised. Then the findings related to Hypothesis II are given.

34.1 Findings in Relation to Hypothesis I

For the purpose of testing the hypotheses formulated, null hypotheses were framed. Hypothesis I states that there exists a relationship between EAMC and selected situational, personal, and family variables. Null hupothesis (Ho I) with sub-hypotheses were framed as presented below.

Ho I: There exists no relationship between EAMC and selected situational, personal, and family variables.

Situational Variables :

Ho I.1 Level of Quality of Housing (LQH)

Ho I.2 Extent of Possession of Consumer Durable Goods (EPCDG)

Ho I.3 Extent of Demands on Main Cook's Time (EDMCT)

Ho I.4 Energy Base of End Uses (EBEU)

Ho I.5 Extension of Activities by Family After Dusk (EAFAD)

Ho I.6 Energy Management Practices of the Family (EMPF)

Ho I.7 Extent of Interaction of Main Cook with Different Spheres (EIMCDS)

Ho I.8 Extent of Interaction of Family with Different Spheres (EIFDS)

Ho I.9 Extent of Participation of Main Cook in NPIC (EPMCNPIC)

Ho I.10 Extent of Participation of Family in NPIC (EPFNPIC)

Ho I.11 Level of Quality of Installation of Mamta Chulha (LQIMC)

Ho I.12 Type of Promoter

Personal Variables :

Ho I.13 Age of the Main Cook

Ho I.14 Education of the Main Cook

Ho I.15 Perception Regarding Available Cooking Fuel Sources (PRACFS)

Ho I.16 Perception Regarding Accessibility to Available Cooking Fuel Sources (PRAACFS)

Ho I.17 Perceived Cost-Benefit Ratio (PCBR)

Family Variables :

Ho I.18 Family Caste

Ho I.19 Family Size

Ho I.20 Landholding

Ho I.1 : There is no relationship between EAMC and LQH.

Pearson product moment correlations resulted in a negative relationship between EAMC and LQH which was not significant (Table 72). The null hypothesis was therefore accepted.

Ho I.2 : There exists no relationship between EAMC and EPCDG.

No definite relationship was found to exist between EPCDG and EAMC (Table 72). The computed `t' values indicated that EAMC of those with moderate EPCDG was significantly different at .01 level from families with low level of EPCDG (Table 73).

Therefore the null hypothesis was partially rejected.

Table 73: Difference Between Mean Scores on EAMC by EPCDG

Group	EPCDG	N	Mean
1	Low	54	22.79
2	Moderate	278	19.59
3	High	58	20.58

Mean	contrast	Difference	`t' value	Level of significance
1	2	3.20	2.71	.01
2	3	0.99	0.86	n.s.
1	3	2.21	1.53	n.s.

Ho I.3 : There is no relationship between EAMC and EDMCT.

Coefficient of correlation between EDMCT and EAMC were computed using Pearson Product Moment formula. No significant correlation was observed between EAMC and EDMCT (Table 72).

The null hypothesis was not rejected.

Ho.I.4 : There is no relationship between EAMC and EBEU.

EBEU was observed to have no significant relationship with EAMC (Table 72). Thus the null hypothesis was accepted.

Ho I.5 : There exists no relationship between EAMC and EAFAD.

The computed `r' values revealed a positive relationship significant at .01 level between EAFAD and EAMC (Table 72).

The `t' test was applied in order to ascertain the influence of EAFAD on EAMC. EAMC differed significantly at .01 level between families who exhibited (i) moderate and high, as well as (ii) low and high level of EAFAD (Table 74).

Table 74: Difference Between Mean Scores on EAMC by EAFAD

Group	EAFAD	N	Mean
1	Low	150	19.47
2	Moderate	153	19.52
3	High	87	22.60

Mean	contrast	Difference	`t'value	Level of significance
1	2	0.05	0.05	n.s.
2	3	3.08	2.90	.01
1	3	3.13	2.96	.01

The null hypothesis was rejected.

Ho I.6 : There is no relationship between EAMC and EMPF.

Product moment correlation computed between EAMC and EMPF revealed a significant (.01 level) positive relationship between

the two variables (Table 72). Significant difference (.01 level) was observed in EAMC when compared by EMPF (Table 75). Families that exhibited high EMPF differed significantly (.01 level) from those who exhibited (i) moderate and (ii) low EMPF. Similarly families belonging to the category of low and moderate EMPF differed significantly from each other in their EAMC.

The null hypothesis was rejected.

Table 75: Difference Between Mean Scores on EAMC by EMPF

Group	EMPF	N	Mean
1	Low	59	15.56
2	Moderate	278	20.49
3	High	53	23.75

Mean contrast		Difference	`t' value	Level of significance
1	2	4.93	4.42	.01
2	3	3.26	2.79	.01
1	3	8.19	6.25	.01

Ho I.7 : There is no relationship between EAMC and EIMCDS.

The EIMCDS was negatively correlated at .05 level with EAMC (Table 72). The `t' values revealed that those with low level of EIMCDS differed significantly (.05 level) in regard to EAMC from those who exhibited moderate level of EIMCDS. The difference in mean score on EAMC was the most prominent between

families of cooks with moderate and low EIMCDS and the least between those with moderate and high EIMCDS (Table 76).

The null hupothesis was rejected.

Table 76: Difference Between Mean Scores on EAMC by EIMCDS Score

Group	EIMCDS	N	Mean
1	Low	58	22.93
2	Moderate	301	19.59
3	High	31	20.77

Mean contrast	Difference	`t' value	Level of Significance
1 2	3.34	2.93	.01
2 3	1.18	0.79	n.s.
1 3	2.16	1.28	n.s.

Ho I.8 : There exists no relationship between EAMC and EIFDS.

The computed `r' values revealed that there is no significant relationship between EAMC and EIFDS. Therefore the null hypothesis was accepted.

Ho I.9 : There is no significant relationship between EAMC and EPMCNPIC.

Since the number of main cooks falling in the low category by their EPMCNPIC was negligible, the low and moderate groups

were combined and treated as moderate group. A positive correlation at .01 level of significance was found between EAMC and EPMCNPIC (Table 72). Main cooks with higher EPMCNPIC differed significantly (.01 level) from those with moderate EPMCNPIC (Table 77).

The null hypothesis was rejected.

Table 77: Difference Between Mean Scores on EAMC by EPMCNPIC

Group	EPMCNPIC	N	Mean
1	Moderate	300	18.86
2	High	90	24.58

Mean contrast	Difference	`t' value	Level of significance
1 2	5.72	6.21	.01

Ho I.10 : There exists no relationship between EAMC and EPFNPIC.

EPFNPIC correlated positively at .01 level with the EAMC (Table 72). The `t' test was applied in order to ascertain the influence of EPFNPIC on EAMC. The `t' values revealed that families with high EPFNPIC were significantly (.01 level) different from those with (i) low (ii) moderate EPFNPIC in regard to EAMC (Table 78).

The null hypothesis was rejected.

Table 78: Difference Between Mean Scores on EAMC by EPFNPIC

Group	EPFNPIC	N	Mean
1	Low	22	16.18
2	Moderate	277	19.16
3	High	91	24.27

Mean contrast		Difference	`t' value	Level of significance
1	2	2.98	1.71	n.s.
2	3	5.11	5.52	.01
1	3	8.09	4.88	.01

Ho I.11 : There exists no relationship between EAMC and LQIMC.

A positive correlation significant at .05 level existed between EAMC and LQIMC (Table 72). Families were found to differ significantly (.01 level) in their EAMC when compared on the basis of LQIMC. The moderate and high scorers on LQIMC were clubbed together since those with high LQIMC were negligible. Families with moderate LQIMC differed significantly (.01 level) from those with low LQIMC in relation to EAMC (Table 79).

The null hypothesis was rejected.

Table 79: Diference Between Mean Scores on EAMC by LQIMC

Group	LQIMC	N	Mean
1	Low	47	10.50
2	Moderate	343	21.51

Mean contrast		Difference	`t' value	Level of significance
1	2	5.35	4.46	.01

Ho I.12 : There exists no relationship in EAMC when compared by type of promoter of NPIC in the three villages.

The computed `t' values revealed that there was a significant difference in EAMC by beneficiaries when compared by type of promoter in the three villages. Beneficiaries in Sindhrot differed significantly (.01 level) from those of (i) Vadadla and (ii) Kanjari when TBSU and NGO respectively installed MC (Table 80). No significant difference in the mean EAMC score was observed in the case of beneficiaries of Kanjari and Vadadla where NPIC was implemented/promoted through non-government organisation and state government respectively.

The null hypothesis was rejected.

Table 80: Difference Between Mean Scores on EAMC by Type of Promoter in the three Villages

Group	Promoter	N	Mean
1	NGO (Kanjari)	130	18.57
2	SG (Vadadla)	130	17.15
3	TBSU (Sindhrot)	130	24.84

Mean contrast		Difference	`t' value	Level of Significance
1	2	1.42	1.50	n.s.
2	3	7.69	8.92	.01
1	3	6.27	7.07	.01

Ho I.13 : There is no relationship between EAMC and age of main cook.

The coefficient of correlation computed between age of main cook and EAMC was not significant (Table 72).

Hence the null hypothesis was accepted.

Ho I.14 : There exists no relationship between EAMC and education of main cook.

To test this hypothesis coefficient of correlation was computed which revealed that there was no significant relationship between EAMC and education of main cook.

The null hypothesis was not rejected.

Ho I.15 : There exists no relationship between EAMC and PRACFS.

A significant positive correlation (.01 level) was found between EAMC and PRACFS of main cook (Table 72). Thus it was evident that there existed a definite relationship between EAMC and PRACFS. Comparison of mean scores revealed that main cooks with high PRACFS were significantly different from those with low and moderate PRACFS at .01 level (Table 81). The mean score for PRACFS was 5.26.

The null hupothesis was rejected.

Table 81: Difference Between Mean Scores on EAMC by PRACFS of Main Cook

Group	PRACFS	N	Mean
1	Low	141	18.93
2	Moderate	206	19.80
3	High	43	26.16

Mean contrast		Difference	`t' value	Level of significance
1	2	0.87	1.00	n.s.
2	3	6.36	4.99	.01
1	3	7.23	5.67	.01

Ho I.16 : There is no relationship between EAMC and PRAACFS.

PRAACFS was observed to have no significant relationship with EAMC (Table 72).

The null hypothesis was accepted.

Ho I.17: There is no relationship between EAMC and PCBR.

The mean PCBR score of main cook was 0.14. To test the above hypothesis product moment correlations were computed between EAMC and PCBR. EAMC was positively correlated with PCBR at .01 level of significance (Table 72).

The `t' test was applied in order to ascertain the influence of PCBR on EAMC. Cooks with high PCBR were significantly different (.01 level) from those with low and moderate PCBR. Main

cooks with low and moderate PCBR differed significantly (.01 level) from each other in relation to EAMC (Table 82).

The null hypothesis was rejected.

Table 82: Difference Between Mean Scores on EAMC by PCBR

Group	PCBR	N	Mean
1	Low	85	13.01
2	Moderate	225	20.85
3	High	80	25.93

Mean	contrast	Difference	`t'value	Level of significance
1	2	7.84	8.62	.01
2	3	5.08	5.49	.01
1	3	12.92	16.11	.01

Ho I.18 : There exists no relationship between EAMC and Family Caste.

To test the above hypothesis `t' test was applied. Significant difference (.01 level) was observed in EAMC when compared by family caste (Table 83).

Table 83: Difference Between Mean Scores on EAMC by Caste

Group	Caste	N	Mean
1	General	329	19.84
2	SC/ST	61	22.07

Mean	Contrast	Difference	`t' value	Level of significance
1	2	2.23	4.13	.01

Families that belonged to general category seemed to be poorer adopters of MC. They differed significantly (.01 level) from those families that belonged to SC/ST category.

Therefore the null hypothesis was rejected.

Ho I.19: There exists no relationship between EAMC and family size.

To test the above hypothesis product moment correlation coefficients were computed between family size and EAMC. However, the `r' values were observed to be not significant between family size and EAMC. Therefore the null hypothesis was not rejected (Table 72).

Ho I.20 : There is no relationship between EAMC and landholding.

No significant relationship was found to exist between EAMC and landholding size. The null hypothesis was accepted (Table 72).

34.2 Findings in Relation to Hypothesis II

Hypothesis II states that there exists a difference in the influence exerted by the selected situational, personal and family variables on EAMC. All variables except two discrete variables, viz., type of promoter and family caste were excluded in stepwise regression analysis carried out to test Ho II.

Ho II : There exists no difference in the influence exerted by the selected situational, personal and family variables on EAMC.

Table 84: Stepwise Regression of EAMC on Different Variables

Variables	Multiple R	R2
PCBR	0.67	0.44
LQIMC	0.68	0.47
EMPF	0.69	0.48
EPCDG	0.70	0.49
EIMCDS	0.71	0.50
EAFAD	0.71	0.50

Stepwise regression analysis was computed to test the above hypothesis. The ordered list of factors revealed the order of the variables by their influence on EAMC. PCBR, LQIMC, EMPF, EPCDG, EIMCDS and EAFAD emerged out as significant variables which explained 50 per cent of variance in EAMC, while the remaining variables were observed to be not significant in the presence of the former set of variables in influencing EAMC. However 44 per cent of the variance could be explained by PCBR. On the basis of these observations it was concluded that there existed a difference in the influence exerted by the selected variables on EAMC (Table 84).

The null hypothesis was rejected.

35. Discussion of Findings in Relation to Hypotheses Testing

To what extent the families adopted MC? Was there any difference amongst families in their adoption level? Could the differential levels of adoption be explained by situational

variables like EIFDS, EIMCDS, EPFNPIC, EPMCNPIC, LQIMC, PCBR EDMCT and so on ? Was there any relationship between EAMC and their personal and family characteristics? Is there any difference in the influence exerted by situational, personal, and family variables on EAMC ? These were some of the questions that formed the basis of analysis of the data gathered in the present study. In addition to situational variables mentioned above, personal and family variables like main cook's age and education level, PCBR, family size, landholding, and the like were chosen to understand EAMC.

Findings in relation to inter-relationships of situational, personal and family variables with EAMC are reported in sequence.

35.1 Situational variables

35.1.1 EAMC in Relation to EPCDG

The range in scores earned by families on EPCDG was 11 to 99 with a mean score of 42.04. Though no significant relationship was observed between EPCDG and EAMC, EPCDG of family asserted an influence on EAMC as evidenced through the computed `t' values. The EAMC of families with low EPCDG was significantly different from those with moderate EPCDG.

The mean EAMC score of those families with low EPCDG was relatively more than those with moderate EPCDG. In other words, families with low EPCDG revealed greater EAMC than those with moderate EPCDG. This could be attributed to the fact that those with low EPCDG had probably more aspirations in relation to standard of living and hence greater desire to acquire more

consumer durable goods which raises family's level of living. It appears that beneficiary families with MC in prefab liners viewed it as a consumer durable good, provided it was user appropriate. MC in prefab liners were installed in beneficiary families belonging to Sindhrot and Vadadla with the former having medium size MCs which are more appropriate to meet user cooking needs. In contrast to MCs in prefab liners (small size) in Vadadla, MCs in mud (medium size) in Kanjari revealed relatively higher EAMC by its families, though the mean EAMC scores in both Kanjari and Vadadla were less than that of Sindhrot (Appendix IV : Table 83). Beneficiary families with low EPCDG thus revealed a tendency to adopt MC to a greater extent than others. However no significant difference was observed between moderate and high scorers of EPCDG in relation to EAMC. It was found that as families' EPCDG increased EDMCT decreased (r = -.491 **). This indicates that EPCDG reduced demands on main cook's time. It is needless to mention that MC leads to cleaner cooking area and less hardship in cooking and related tasks and thereby would reduce demands on main cook's time and their drudgery. Those who earned low score on EPCDG were better adopters of MC. In other words these beneficiary families revealed an inclination to acquire and adopt an improved technology like Mamta chulha, probably to save their human and non-human resources and to enhance their level of living.

35.1.2 EAMC in relation to EIMCDS

The range of scores on EIMCDS was observed to be 10 to 98. The mean EIMCDS score was 55.02. A negative correlation was found

between EIMCDS and EAMC (r = -.111*). Moreover families with moderate EIMCDS were significantly different from those with low EIMCDS in their EAMC. In general, families appeared to have low EAMC as main cooks' interaction with different spheres increased. This might be due to the fact that as their interaction with different spheres increased, their extent of participation in NPIC decreased (r = -.132**). Alternatively, it could be explained by the fact that the main cook's spheres of interaction were confined to immediate environment in most cases except a few in whose case it included the near environment as well. Since main cooks were not exposed much to outside world beyond the boundaries of their village as evidenced through their EIMCDS, their awareness on innovative cooking technologies was rather very low (Appendix IV : Table 53). EIMCDS seemed to be dependant on variables like landholding, EIFDS, and EBEU positively and on EPMCNPIC and EPFNPIC negatively (Table 72).

Apparently when cooks from relatively better socio-economic position interacted with different spheres, especially, the larger environment to a greater extent than their counterparts from other socio-economic groups, it seems that they would be having wider exposure and choice. In such cases they might opt for sophisticated technologies like gas stove rather than a non-conventional cooking technology.

35.1.3 EAMC in relation to EAFAD

With an increase in EAFAD, EAMC increased (r = .129**). Families revealed difference in their overall EAMC when compared

on the basis of EAFAD. However the difference was not pronounced between the two lower categories of families by EAFAD score. In other words, the families with higher EAFAD score differed from those families with i) low and ii) moderate EAFAD score. As families EAFAD increased, their EAMC too increased. That is, those families who indulged in activities after dusk to a greater extent were better adopters of MC than their counterparts. Apparently these families had higher aspirations for a better standard of living. Further, EAFAD increased with an increase in EIFDS (r = .321**) which implies that an increase in their exposure to outside world led to their increased indulgence in activities after dusk. Moreover, as family size increased their EAFAD too recorded an increase as evidenced through the significant positive correlation (r = .204 **). EAFAD was positively correlated to EPMCNPIC and EPFNPIC (r = .252 ** and r = .213 **). In other words, those families with higher EAFAD revealed greater participation of main cook and family in NPIC. This in turn might have enabled them to learn about the use of chulha which resulted in higher EAMC. The EAFAD scores were interpreted such that the higher the score, the higher the indulgence in activities after dusk, the greater the demand on energy. Hence families with greater EAFAD may be inclined to reduce energy consumption in other ways. This might have prompted those families with higher EAFAD adopt MC as a means to conserve energy to keep their biomass consumption under control. Further the cleaner, smokeless and cooler environment resulted in accomplishment of household chores in a more pleasant manner and

with less fatigue in addition to healthier living. This seemed to have facilitated higher EAFAD and in turn higher EAMC.

35.1.4 EAMC in Relation to EMPF

The mean score of EMPF was 52.52. It correlated positively with EAMC (r = .329 **) at .01 level. Families showed significant difference in their EAMC by their EMPF, the difference being marked between families with low and moderate, low and high as well as high and moderate levels of EMPF. Good managers look for ways and means of improving the use of resources to maximise satisfaction from its use, to avoid wastage and to conserve/preserve it. Hence those families that revealed better EMPF seemed to strive to conserve fuel resource through the use of improved technology. EMPF of the family did not reveal any significant association with the selected demographic characteristics. Apparently when EMPF was high, EPFNPIC and EPMCNPIC were also high (r= .199** and r= .183** respectively). Participation in NPIC might have enabled them to learn the use, care and maintenance of MC which might have in turn resulted in better EMPF geared towards energy conservation. This in turn might have helped them to perceive benefits and costs of possessing and using an MC better. On the other hand, they might have been more conscious about their human and monetary input in fuel procurement. To conserve the resources they might have strived for the adoption of MC. Thus it implies that the better the energy management practices (EMPs) followed by the family, the higher the extent of adoption of MC.

35.1.5 EAMC in Relation to EPMCNPIC

The mean score of EPMCNPIC was 10.73. It was positively correlated with EAMC (r = .302 **). The extent of adoption of MCs where cooks had moderate participation was different from those where they had high participation in NPIC. Mean EAMC score of the former was 18.86 as compared to that of 24.58 of the latter.

It implies that where EPMCNPIC was high, the EAMC was high. In other words, families where the main cooks participated in NPIC their EAMC was better. These findings are comparable with that of Singh (1975) with reference to innovations in teaching. He reported that the institutions which have teacher educators exposed to foreign influences through visits, literature and other means of communications, have been able to adopt a large number of innovations in teaching.

With reference to cookstoves, Aprovecho Institute (1984), Sarin (1985), Natarajan (1992), and NCAER (1993) suggested that user education, training and creation of awareness and publicity may be stepped up further with special emphasis on the quality of training oriented towards use, repair and maintenance of chulha and usefulness of the programme for society in general and households in particular. George and Vingle (1990) in their study found that inadequate education in regard to maintenance and repair of chulha was the reason for failure of continued use of IC. Balakrishnan (1991) pointed out that wherever adequate users' training has been conducted and the women have understood the correct use of the improved stoves, they are happy with the

stoves installed in their houses. TBSU (1991-92) in its feedback survey noticed that mostly chulhas were demolished as the beneficiaries did not know how to use them which was due to lack of user education. As Hassan (1990) rightly said that it is women, the mother who usually keeps the traditions and insists on keeping them. Hence they should be alerted regarding the importance of adopting a new technology.

Since any technology makes cetain performance demands upon the person who adopts it, it should be easy to use or understand. It was evident that the main cooks with higher score on EPMCNPIC who had seen the effectiveness of MC through live demonstrations, perceived its advantages in a better manner than their counterparts with less participation. EPMCNPIC was positively correlated with PRACFS (r = .535 **). This implies that with an increase in EPMCNPIC their perception regarding the scarcity of available sources of cooking fuels too revealed an increase or vice versa. As a result they might have revealed the tendency to reduce the consumption of fuel through the use of a more efficient cooking device like MC.

35.1.6 EAMC in Relation to EPFNPIC

EPFNPIC was positively correlated with EAMC (r = .308 **). Families were significantly different in their EAMC when compared by their EPFNPIC. Families with high EPFNPIC differed significantly from those with low and moderate scores on EPFNPIC.

By and large, families who participated in NPIC through cost, labour and material sharing, and involvement in

installation as well as UECs were better adopters than those with lesser participation. Probably these families understood better the need to switch over to MC from TRC and learnt well about the working mechanism of MC through their observation and participation in cooking demonstrations and lecture cum discussions. Hence were more convinced about the advantages of MC. These observations were in line with that of Kalra and Singh (1990) wherein they reported that the mean adoption score of projected group was significantly higher than that of control group due to the exposure to different education technologies. Sharma (1979) based on his study concluded that the more the linkages are, the more effective will be the day-to-day contact and exchange of information and hence the greater will be the level of adoption of innovations.

Only when beneficiaries undergo training they would understand the operation mechanism of a technology which will enable them to adopt it in a better manner. NCAER (1993) reported that a significant improvement in the proportion of working IC was observed in households who have undergone training on use of chulha repair and maintenance against untrained households. Administrative approval of NPIC (1991-92), Govt. of India insists that the nodal/implementing agencies should organise user's training camps through SEW to educate the beneficiaries in the proper use, repair and maintenance of chulha to ensure higher functionality rate.

35.1.7 EAMC in relation to LQIMC

A positive correlation was found between LQIMC and EAMC (r=.114 *). Families with low LQIMC were significantly different from those with moderate LQIMC. The mean EAMC score of those with low LQIMC was 10.5 against that of 21.51 of those with moderate LQIMC.

It is obvious that for any technology, the quality of installation ought to be good for it to be accepted. In relation to MC, its quality of installation is crucial not only in being accepted but also in meeting the objectives like conservation of biomass for which it is promoted. A major share of scores on LQIMC is related to retention of dimensions as per design specifications. A little over one-third of MCs covered under the present investigation were as per design specifications and properly installed. Feedback surveys reported that chulhas were demolished or rejected by beneficiaries of NPIC due to faulty construction of chulha (George and Vingle, 1989; IIT Annual Report, 1989-90 and TBSU Annual Report, 1990-91, 1991-92). When sealing of chimney to roof is not done well, it will lead to damage to the chulha due to water leakage during monsoon which in turn would lead to low efficiency or to an MC that is beyond repair. George in TBSU Annual Report (1993) emphasised that chimney sealing and clamping were very crucial for successful adoption and sustained use of chulha by users. NCAER (1993) reported that the working performance of chulhas fitted with pottery/ceramic liners was distinctly better with a proportion of

0.61 compared to 0.51 of these chulhas without the liners. The EAMC by beneficiary families was low with low LQIMC and vice versa. The poor construction of MC's in mud by SEWs might have led to low LQIMC and low EAMC. While construction of MCs of appropriate size in prefab liners might have contributed to high LQIMC and high EAMC. LQIMC was observed to be correlated positively with EPFNPIC (r = .537**) and EPMCNPIC (r=.268**). The increased participation of families and main cooks in NPIC might have equipped them with functional capabilities to check and ensure relatively higher LQIMC which in turn might have resulted in a desire on the part of beneficiary families to adopt such MCs in day to day cooking.

35.1.8. EAMC in Relation to its Type of Promoter

The improved chulha under investigation in the present study was MC and the locations of the study were Kanjari, Vadadla and Sindhrot. These sites were selected purposively in view of the fact that in each of these villages MC was implemented and the grassroot level promoters in each were distinctly different from the other. While non government organisation (NGO) implemented NPIC in Kanjari, State Government (SG) implemented NPIC through its Taluka/Block level net work in Vadadla and Technical Backup Support Unit established under NPIC (TBSU-NPIC) implemented NPIC in Sindhrot. Self Employed Workers (SEW) engaged by each of these promoters along with the involvement of their own personnel promoted NPIC in these villages. The Administrative Approval issued by MNES, GoI during respective financial year (1991-92) implementation of NPIC along with targets alloted to each state

is circulated to nodal departments, agencies, TBSUs and Regional Offices of MNES all over the country. The promoters and implementors of NPIC are expected to follow the guidelines and strategies and policies provided in the Administrative Approval in its improved stove dissemination programme to ensure greater success of NPIC. The type of promoter was identified as a variable to study its impact on EAMC by beneficiary families as in the course of the study it was observed that there was remarkable difference in the implementation strategies followed by each in spite of the guidelines provided by government of India (1991-92).

The EAMC when analysed by it's grass-root level promoter showed that beneficiary families who secured MC through NGO and SG differed significantly in their EAMC from those who secured through TBSU. In other words, beneficiary families of MC promoted by TBSU-NPIC in Sindhrot were significantly different in their EAMC from those in Kanjari and Vadadla where NGO and SG respectively promoted MC. However no significant difference was observed in EAMC of beneficiary families of SG in Vadadla and NGO in Kanjari. Beneficiary families of Sindhrot where the promoter was TBSU-NPIC revealed a mean EAMC score of 24.84 which was relatively higher as compared to 18.57 and 17.15 of their counterparts who secured MC through NGO in Kanjari and SG in Vadadla respectively.

These findings could be attributed amongst other things to the specific strategy of implementation of NPIC followed by the

three promoters, namely, SG, NGO and TBSU. While medium size MCs in mud were installed in Kanjari by NGO, small size MCs in ceramic liners were installed in Vadadla by SG network. On the other hand, medium size MCs in ceramic liners were installed by TBSU in Sindhrot. It emerges from the study that user appropriateness is equally important, if not more, important as user appeal of the model of chulha. The latter could be attained through maintaining satisfactory LQIMC. Medium size MC is more appropriate to user needs than small size MC as the former can meet all cooking needs of an average family whereas the latter can meet the cooking needs of a small size family due to its small sized potseats that can accommodate vessels with less capacity. Moreover it can effectively cook only small size rotla which implies that the cook would be required to change her customary habit of making large size rotlas, to make small ones in large numbers consuming more time and cooking fuel. On the contrary if she continues making large size rotlas on her large size `tavdi' - clay roasting pan, the periphery of the rotlas remains uncooked due to low heat beyond the pot seat circumference, clay being a relatively poor conductor of heat. Prefab lined MCs were promoted by SG and TBSU-NPIC in Vadadla and Sindhrot respectively, though, in the former it was small in size and in the latter medium in size. In spite of both MCs being with ceramic liners, i.e., a product of similar finish and quality, EAMC by families was remarkably higher in Sindhrot than in Vadadla and that of Sindhrot was significantly different from that of Vadadla too. The identification of proper size of MC

appropriate for a cross section of families by TBSU-NPIC might have contributed to relatively higher EAMC in Sindhrot.

The beneficiary families of NPIC through NGO in Kanjari and SG in Vadadla were dissatisfied with their MCs in view of the fact that they could not cook `rotla' to their satisfaction on their new chulhas (Appendix IV : Table 65). This could be attributed in the former case to the fact that MC, especially the firebox on which rotla is cooked, was as per design in only 15 per cent with the rest being smaller in diameter. In the latter case though MC promoted by SG was as per design, it was small in size and inappropriate to cook large size rotlas as it was a design appropriate for small quantity cooking and rotlas of relatively smaller diameter.

MCs promoted by NGO in Kanjari, were medium in size. These were made of a mixture of clay, dung and fine dust. EAMC by families in Kanjari was observed to be significantly different from that of Sindhrot and mean EAMC scores were 17.15 and 24.84 for the former and latter respectively. The design in mud though appropriate to meet cooking needs of an average family, were not accepted by its receivers (beneficiary families) probably due to its lack of user appeal which could be attributed to poor quality of installation as evidenced by the mean LQIMC score of 16.8 as compared to 22.5 of Sindhrot (Appendix IV : Table 68). Moreover mud chulhas tend to form cracks which widen and deepen as drying occurs unless the clay - dung mixture had been cured and mixed homogenously and compacted tightly in the making. The cracks thus formed unless attended to by SEW or by its beneficiary would

render the chulha lose its appeal and utility. Hence its rejection subsequently within a short period of time, i.e., 50 per cent in these two villages in less than 3 months as against 5 per cent in Sindhrot and 98 per cent within 9 months as against 17 per cent within 9 months in Sindhrot (Appendix IV : Table 78). Further the relevance of user appropriateness and user appeal is substantiated by the response of cent per cent and 65 per cent beneficiaries of NGO and SG as against 27 per cent of TBSU-NPIC that they would switch over to TRC when their MC's developed cracks (Appendix IV : Table 81).

When prefab lined chulhas are promoted, it is needless to mention that a standardised consumer product reaches every beneficiary family and these are superior to mud chulhas in that its dimensions cannot be tampered with by SEW or user, its performance is assured with appropriate user training, it is more durable and with longer life, its parts can be replaced, if need be, provided infrastructure for the same is created and its installation easy and fast and can be set in a brick platform. It has greater user appeal and beneficiary cost sharing comes voluntarily without coersion as they perceive a product-MC in prefab liners-reaching their kitchens (George, 1992).

NCAER (1993) found that the working performance of chulhas fitted with pottery/ceramic liners was distinctly better compared to those chulhas without the liners. As Maiti and Gupta (1993) pointed out ceramic liners being prefabricated material, were easy to install, consumes less time and effort in fixing, the dimensions can be retained for long time and possess high

mechanical strength. Regular mud washing of chulhas which alters the dimensions can be avoided through the use of ceramic liner. As the combustion chamber remains hot, additional fresh fuel gets immediately ignited without air blowing which in turn saves fuel. Apparently when users experience these benefits they would be more inclined to adopt MC.

As per Administrative Approval on Strategies and Policies of Implementation of NPIC, GoI (1991-92), user involvement, user education, development of skilled man power, installation of ICs by trained SEWs, follow-up of ICs by SEWs for a period of at least one year, publicity and awareness generation and monitoring are integral to dissemination of ICs under NPIC. The respondents from Kanjari where NGO promoted MC and Vadadla where SG promoted weak user education and training, MC reported low rate of involvement in these, low quality of installation, inappropriate size of MC, poor follow-up and monitoring of MCs by SEWs, in contrast to those from Sindhrot where TBSU-NPIC promoted MC (Appendix IV : Table 63). User education and training are of paramount importance in creating awareness about energy scarcity, need for biomass conservation, merits and demerits of MC and cooking and fuel management at MC which would enable users to assess the benefits and costs due to ownership of MC. EPFNPIC and EPMCNPIC were the highest in case of beneficiary families of MC, installed by TBSU-NPIC with those of SG and NGO in declining order. The relatively higher EPFNPIC and EPMCNPIC of those in Sindhrot might have led to a better understanding of stove technology which enabled them to critically evaluate costs and

benefits of being a user of MC and take decisions that led them from awareness generation stage to adoption stage. PCBR was observed to be positively correlated to EAMC at .01 level of significance and beneficiaries of MC through TBSU-NPIC in Sindhrot exhibited the highest PCBR while those of SG in Vadadla and NGO in Kanjari exhibited very low PCBR. The low EAMC in Vadadla and Kanjari could be attributed to weakness in strategies pursued with reference to UECs by promoters of MC in these sites. Follow-up and monitoring undertaken by TBSU was stronger than others which led to a relatively higher EAMC by families in Sindhrot.

Moreover, TBSU, over and above the implementation strategies specified by the administrative approval, had conducted in Sindhrot publicity campaigns through posters on biomass conservation, a series of focus group discussions with a cluster approach, cooking demonstrations both on TRC and MC to highlight merits of MC over TRC, and follow-up of MC at regular intervals which might have helped families make transition from TRC to MC smoothly and adopt MC. Apart from the above mentioned strategies, people's participation and contribution towards labour, material, and cost of installing MCs might have prompted the beneficiary families adopt MC.

35.2 Personal Variables

35.2.1 EAMC in Relation to PRACFS

Significant relationship was observed between PRACFS and EAMC. It correlated positively with EAMC ($r = .198^{**}$). Families

were different in their adoption level when compared by their PRACFS. Families with high PRACFS were significantly different from those with i) low and ii) moderate PRACFS.

Families where main cooks exhibited high PRACFS, were more inclined to adopt MC than those with low and moderate PRACFS as evidenced by their higher mean score on EAMC. Majority of the respondents reported market in nearby town and nearby village to be the available sources for kerosene and own/private farm for non-commercial fuels, i.e., mainly fuelwood (Appendix IV : Table 39). However majority of them collected fuelwood from wayside/forest while kerosene was purchased mainly from local shop. Scarcity of fuel would force people to go farther and spend more time and energy to procure cooking fuel.

An increased PRACFS resulted in greater EAMC. This could be attributed to the fact that alongwith increased PRACFS, they might be aware of the difficulty associated with the sources from where they could procure fuel which might have enhanced their EAMC. In other words, if main cooks associated greater effort in procuring depleting fuel from available sources, then their families would be inclined to conserve the fuels by adopting a technology that is efficient to cut down cooking fuel consumption. Moreover PRACFS seemed to be dependent on landholding negatively ($r = -.128^{**}$) which shows that as the landholding increased, PRACFS decreased. This might be due to the fact that those who owned land, mostly might be procuring fuel from their own land and hence might not have concerned themselves to find out available cooking fuel sources. By raising awareness

level of main cooks and their families regarding available sources of fuel and increasing scarcity of biomass and its impact on ecosystem, it would be possible to enhance EAMC.

35.2.2 EAMC in Relation to PCBR

The mean PCBR was 0.14. A positive correlation was observed between EAMC and PCBR (r = .667 **). Families with high PCBR were different from those with low and moderate PCBR. Similarly families with low PCBR were significantly different from those with moderate PCBR.

As PCBR increased, EAMC increased. This implies that those families with main cooks who perceived more benefits than costs in owning an MC, adopted it to a greater extent than others. Only when users perceive the profitability from adoption of any innovation, would they be more inclined to adopt it. It could be said that as users were satisfied with the merits of MC, they adopted it in daily cooking. Bhola (1967) stated that the nature and extent of investment and type and amount of return will determine the probability of diffusion of an innovation. Those with high PCBR might have evaluated MC not only through their own experience at it, but also by comparing it with their TRC.

PCBR was positively correlated with EMPF (r = .354 **), PRACFS (r= .408 **), EPMCNPIC (r= .403 **), EPFNPIC (r= .474**), LQIMC (r = .403 **) and EAFAD (r = .205 **). PCBR of main cooks increased with an increase in EMPF, PRACFS, EPMCNPIC, EPFNPIC, LQIMC and EAFAD. Those with low PCBR were those who did not

participate in NPIC and those whose families' EMPs were not conservation oriented. In such cases LQIMC was seen to be of low level. By campaigning on the merits of MC, and by facilitating participation of beneficiary families and main cooks in UECs and in NPIC leading to high LQIMC, it would be possible to achieve higher PCBR and thereby greater EAMC. In other words, it seems that if promoters follow the guidelines as per Administrative Approval issued by MNES, GoI, the beneficiaries would exhibit higher EAMC.

35.3 Family Variables

35.3.1 Family Caste

The `t' values revealed that beneficiary families from SC/ST category were significantly different from those of general category. The latter might be having enough resources to ensure adequate supply of cooking fuels that they did not recognize the need to adopt MC to the extent to which the former did. Moreover, LQIMC might have been far below their expectation because of which they might have rejected MC. The beneficiary families from SC/ST category that revealed higher EAMC belonged to Kanjari where NGO had implemented MC. The main cooks reported that they were motivated to adopt MC due to the possibility of their receiving `panniyaru' (mud water tank) if they adopted MC as promised by NGO. This could have resulted in a relatively higher EAMC by them as compared to those from general category.

PCBR, LQIMC, EMPF, EPCDG, EIMCDS and EAFAD were seen to be the major predictors of EAMC by beneficiary families.