CHAPTER VIII

FACTORS INFLUENCING THE USE OF ELECTRICITY FOR IRRIGATIONAL PURPOSES

In this chapter, an attempt is made to analyse the factors which influence the use of electricity for irrigational purposes. One of the ways in which these factors can be analysed is to compare and contrast the conditions obtaining for users of sample modes viz., electric motors, oil engines and bullock-operated lifts. However, the sample design adopted for the study (primary unit of sampling being mode of irrigation) would not permit such comparison, since the possibility of cultivator covered by sample of one mode using also other types of mode could not be ruled out due to fragmentation of irrigational holding. Thus, in certain cases, the same cultivator was covered twice in the samples of two different

modes of irrigation. Yet there is another reason why it is not possible to consider all the farmers covered by samples of three modes of irrigation. Specially, in respect of electric motors and oil engines, it was observed that not all such sample units were wholly owned by the respondents. In many cases they were jointly owned by partners in the well with investment and operational cost being shared in proportion to the ownership rights in the well. In such cases, although it was not difficult to estimate the total cost and the total utilisation of such units by contacting one of the users (partners), it was difficult to gauge the economic conditions of all the partners owning the unit by contacting only one among them. Nor was it possible to contact all the partners of such units since in some cases they numbered more than 10 with some of them employing farm-servants who could not furnish required details. Hence, for comparing the economic conditions of users of different modes, only such farmers using motors and engines are considered who fully owned their units.

Incidentally, it may be mentioned here that in the analysis of certain factors like ownership right in the well and choice of a mode, the comparison is not only between farmers covered by three sets of samples, but also between different wells of the same farmers who were found to be owning/utilising two different types of modes on two wells.

Factors under consideration

The factors influencing the use of electricity for irrigational purposes have been broadly classified into three categories, viz., (i) socio-economic factors (ii) factors relating to agrarian structure such as fragmentation of holdings and pattern of ownership in wells, and (iii) other factors.

(i) Socio-economic factors : Under the group of socio-economic factors, (a) size of cultivated holding and income from subsidiary occupation have been considered as an indicator of economic status of the farmer (b) level of education has been taken into account to find the awareness to technological change and the willingness to adopt it, and (c) size of family, particularly the number of adult members working on farms, has been considered to find out the relationship between adoption of labour-saving mechanised unit and the relative scarcity/ abundance of family labour.

(ii) Agrarian structure : In the analysis of factors relating to agrarian structure, the influence of ownership right in the well and net area under the command of well on choice of mode is analysed. Also, under this set of factors, the observed practices in operation of jointly-owned mechanised modes (electric motor and oil engine) are described with a view to analyse prospects of joint-ownership of the modes. Further, the

composition of irrigational holdings of farmers using oil engines and their response to the question on shift to electricity is analysed to find out the influence of fragmentation of holdings on use of electricity.

(iii) Other factors : Under this set of factors, the importance of disposability of previous mode, particularly oil engine, and the role played by local leadership in the development of use of electricity for irrigational purposes have been analysed. For this purpose, the analysis of time lag in the connection of selected electric motors is undertaken.

As a pre-requisite of analysis of the above factors, it may be relevant to describe the ownership pattern of modes of irrigation of the cultivators covered by samples of three modes of irrigation.

Ownership pattern of modes of irrigation
of cultivators covered by the study

The table 8.1 elaborates further the description of ownership pattern of modes of irrigation of cultivators presented in Table 3.8 in Chapter III. As stated earlier, the primary consideration in the sample is the selection of modes of irrigation rather than selection of farmers. However, as stated earlier, it was observed during the survey that the the cultivators many a time owned even other types of mode of

Table 8.1 : Distribution of cultivators by ownership pattern of modes of irrigation.

Sr. No.	Sample Mode	Numbers of Cultivators																	Owning the units of two types of modes besides sample mode	Total
		Owning only the units of sample mode			Owning the units of only one other type of mode besides the sample mode															
					Less than one unit of sample mode plus Unit of			One Unit of sample mode Plus					More than one unit of sample mode Plus						
								Less than a unit of		One or more units of			Less than a unit of		One or more units of				
		Less than a unit	One Unit	More than one unit	Mode I	Mode II	Mode III	Mode I	Mode II	Mode I	Mode II	Mode III	Mode I	Mode II	Mode I	Mode II	Mode III		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I	Electric Motor	18	16	8	-	1*	6	-	-	-	2£	15@	-	-	-	1	2	-	69
II	Oil Engine	9	32	5	-	-	-	2*	-	3£	-	7	-	-	-	-	-	2	60
III	Bullock Lift	-	54	-	-	-	-	2	-	1@	1	-	-	-	-	-	-	1	59
	Total	27	102	13	-	1	6	4	-	4	3	22	-	-	-	1	2	3	188

Note: As stated in Chapter III, three cultivators were covered twice, i.e., under two sample modes each. In the above table however, they have been shown separately under both the sample modes wherein they were covered. In effect, therefore, only 185 cultivators were covered in the sample and not 188 cultivators as shown in the table.

* £ @ Notations used to locate the farmers who were covered twice. Since twice selected farmers using two modes of lift are shown under each of the sample modes wherein selected, each notation for three twice-selected farmers appears twice in the table above. Each notation indicates that only one of the farmers within the cell is selected twice.

irrigation besides the type for which selected. Table 8.1 classifies the cultivators covered under the samples of modes of irrigation on the basis of their ownership pattern of different modes of irrigation.

Although the table is self-explanatory, few observations on the table would be in order. Whereas the cultivators were observed to be owning less than one unit of mechanised modes and were sharing the ownership of such units, sharing of units was not observed in respect of bullock-operated lifts. With the low cost lift equipment (barring the cost of bullocks) for bullock-operated lift and no monetary transactions involved in the purchase of such equipment, it was natural to find that it was not jointly owned. In respect of bullocks also, their hiring was observed rather than their joint ownership. Because of the multiple uses of bullocks and timely requirement for different agricultural operations, their joint ownership, perhaps, is rendered difficult.

It should be however noted that not all the units of the 'sample mode' of the cultivators owning more than one unit are considered for working out the cost of irrigation, by the mode. The sample design being oriented towards representing each mode of irrigation and the selection of the units of each mode being independent of its ownership by the cultivator, not all the units of any type of mode owned by a

cultivator have been considered in the sample for working out the cost of irrigation.

It can also be observed from the above table, that some of the cultivators, who got selected under the 'bullock operated lift', were also owning mechanised type of lift, just as some of the cultivators who got selected under mechanised type of lift (electric motor and oil engine) were found to be using bullock-operated lift as well.

Hence, in comparing the socio-economic conditions of the cultivators owning mechanised type of lifts with those not owning mechanised type of lift, such of the cultivators covered under 'bullock operated lift' but found to be owning also mechanised type of lift have been considered along with the group of farmers covered by mechanised types of lift. In other words, for the purpose of above-stated comparison, under the category of cultivators, "not owning mechanised type of lift", only such cultivators are considered (54 in number, see column 4) against 'bullock lift') who were found to be owning nothing but bullock operated lift.

Within the category of cultivators, "owning mechanised type of lift", not all are considered for the aforestated comparison. Under this category, only such of the cultivators are considered who were found to be owning fully at least one unit of mechanised type of lift, since, unless the cultivator

had owned his mechanised unit fully, it is not possible to establish relationship between the economic status of the cultivator, his education, etc. and employment of a particular type of mode.

Based on the above considerations, the number of cultivators obtained in two categories viz., owning mechanised unit and not owning mechanised unit, is 96 and 54, respectively. For the [illegible] cultivators of these two categories, in Table 8.2, we have compared the average size of their holding, average monthly income from subsidiary occupation, average cultivated holding per adult family member working on farm and the level of education to find out the relationship between the performance on these counts and a particular type of mode adopted by the cultivator.

Although we are primarily concerned with the factors influencing the use of electricity for irrigational purpose, in the following table, we have pooled together cultivators using electric motor and those using oil engine under 'mechanised type of mode' and compared certain indicators of socio-economic status of the owners of 'mechanised type of mode' vis-a-vis owners of non-mechanised (bullock-operated lift) type. This has been done for following reasons :

(a) For a cultivator using bullock-operated lift, oil engine was as much an alternative mode of irrigation as an

electric motor was.In fact, for a cultivator then operating with bullock lift, the possibility of his shift to an oil engine was more than to an electric motor, since the electricity had come to the village at a later date with respect to oil engine.

(b) These indicators of socio-economic status, considered in table 8.2 have very little relevance for oil engine users from the point of view of prohibiting them from switching over to electricity so that their performance on these indicators be compared with those of users of electric motors. In fact, an oil engine is more costly than an electric motor, is equally labour saving as motor, and its operation and maintenance involve as many complexities as those of motor.

Comparison of Socio-economic indicators of cultivators owning mechanised type of lift and not owning mechanised type of lift.

In table 8.2, we present average picture of the indicators of socio-economic status of two sets of cultivators. The first two indicators enumerated in the table viz., size of holding and income from subsidiary occupation are expected to reflect the economic well-being of the cultivators. Although third indicator, namely, the acreage per adult family member working on farm, does not in any way denote the status of the family,

Table 8.2 : General socio-economic characteristics of cultivators owning and not-owning mechanised type of mode.*

Type of Mode	No.of farmers owning the mode fully	Average size of cultivated holding	Income from non-farming activities		Average acreage per adult family member working on farm	Number of Farmers reporting educational qualification as under					
			No.of farmers reporting	Average monthly income		Illiterate	Upto primary schooling	Upto Secondary schooling	Upto High School	Post School Diploma	Graduate
1	2	3	4	5	6	7	8	9	10	11	12
I. Mechanised type	96	23.020	53	385	8.515	9	46	22	14	4	1
II. Non-mechanised type	54	14.531	18	130	2.522	20	33	-	-	-	1

* Not owning a mechanised mode denotes ownership of non-mechanised type of mode (bullock operated lift) as the sample design precludes inclusion of farmers not-owning any of the 2 types of mode.

it has been included in the table to see the extent of relationship between the relative abundence or scarcity of family labour and the type of mode adopted. Finally, the level of education of the cultivator is included to indicate the awareness to a technological change, the willingness to understand the complexities of a mechanised type of mode and to adopt the same.

It can be observed from table 8.2 that, on an average, the score on the parameters enumerated in the table by the farmers having mechanised type of lift vis-a-vis those not having, put them in favourable conditions so far as the adoption of mechanised mode was concerned.

The average size of the cultivated holding of farmers owning mechanised type worked out to be 1.60 times the cultivated holding of the farmers of the other category. More than 55 per cent of the farmers owning mechanised type of lift had reported earning from subsidiary occupation, as against 33.3 per cent of the farmers in the other category reporting it. Further, the average monthly income from subsidiary occupation for the reporting farm families of the former category was almost 3 times the average monthly income derived from subsidiary occupation by the families of the latter category, reporting such income. Literacy-wise, it is observed from the above table that the farmers, except one, owning the non-mechanised type of

mode were either illiterate or having education at most upto primary-level. On the other hand, it may be seen that among the farmers owning the mechanised type of mode, more than 40 per cent had education beyond primary-level. Further, it is interesting to note that among the farmers owning mechanised type of mode, about 20 per cent had completed their school-education and the percentage share of the illiterate farmers was only 9.4 per cent. As against this, as high as 37 per cent of the farmers having non-mechanised type of mode were illiterate.

The table 8.2 also shows the relative abundance of family labour obtaining for the farmers owning only the non-mechanised type of mode vis-a-vis the farmers in the other category. As can be seen from column 6 of the above table, the average acreage per adult family member working on farm for mechanised type of mode was almost 3.4 times the same for the non-mechanised type of mode, being at the levels 8.515 and 2.522 respectively.

The detailed scrutiny of these factors indicates that there is association between these factors and adoption of a particular type of mode. In table 8.3, the distribution of farmers in two categories (owning and not owning mechanised type of mode) by their size of cultivated holding, average monthly income from subsidiary occupation and level of education is presented. The following observations emerge out of table 8.3.

Table 8.3 : Distribution of cultivators owning and not owning mechanised type of mode on cultivated holding, level of education and income from subsidiary occupation.

Size of cultivated holding (In acres)	Total No.of cultivators		Average monthly income(In Rs.)from subsidiary occupation		Level of education					
					Illiterate		Upto Primary		Secondary & above	
	Owning (1)	Not owning (2)	Owing (3)	Not owning (4)	Owning (5)	Not owning (6)	Owning (7)	Not owning (8)	Owning (9)	Not owning (10)
0-less than 5	2	5	200 (2)	50 (1)	-	4	-	1	2	-
5-less than 10	16	10	250 (12)	85 (5)	-	3	2	7	14	-
10-less than 15	17	16	235 (9)	85 (3)	1	4	12	12	4	-
15-less than 20	15	10	270 (10)	130 (3)	1	3	6	7	8	-
20-less than 30	24	10	670 (11)	160 (4)	4	6	12	4	8	-
30 & above	22	3	555 (9)	325 (2)	3	-	14	2	5	1
Total	96	54	385 (53)	130 (18)	9	20	46	33	41	1

Note: Figures in brackets indicate number of farmers reporting income from subsidiary occupation.

(a) Columns (1) and (2) of the table indicate that proportion of farmers of the category owning mechanised type of mode covered by bigger sizes of cultivated holding were larger than that of farmers of the category, not owning mechanised type of mode. Whereas nearly 50 per cent of the farmers of the category owning mechanised type of mode were covered by sizes of holding of over 20 acres, less than 25 per cent of the farmers of the category not owning mechanised type of mode were covered by the sizes of holding of over 20 acres.

(b) Columns (3) and (4) of table 8.3 would show that between two categories of farmers, larger proportion of farmers of the category owning mechanised type of mode reported income from subsidiary occupation. Further, average monthly income per farmer reporting such income from subsidiary occupation was considerably higher for the category owning mechanised type of mode in comparison to farmers in the other category, in all the sizes of cultivated holding. This higher flow of cash at regular interval must have facilitated the farmers belonging to the category owning mechanised type of mode to adopt them, since its operation required cash on hand to meet their operational and maintenance expenses.

(c) Columns (5) to (10) of the table would reveal that educational status of the farmers owning mechanised type

of mode was generally higher in relation to that of farmers not owning mechanised type of mode. On one hand, incidence of illiteracy was lower and on the other, proportion of farmers reporting education beyond primary level was higher in the category of farmers owning mechanised type of modes vis-a-vis the farmers in the other category.

Like-wise in table 8.4, we have presented distribution of two sets of cultivators on acreage (in size-groups) per family labour working on farm. The acreage per family labour is expected to reflect the degree of availability of family labour. Since the acreage per family labour is related to the size of cultivated holding of the cultivator, in table 8.4, we have presented the distribution of two sets of cultivators on acreage per family labour with respect to their sizes of cultivated holding.

It can be observed from the table that acreage per family labour was generally higher for the category of farmers not owning mechanised type of modes as compared to that obtaining for farmers in the category owning mechanised type of modes. This is evident from the percentage of farmers in two categories covered in different sizes of acreage per family labour. In the lower size-group of acreage per family labour of less than 3 acres, while nearly 80 per cent of

Table 8.4 : Distribution of cultivators owning and not-owning mechanised type of lift on cultivated holding and acreage per family member working on farm.

Size-group of cultivated holding (In acres)	Acreage per family labour working on farm								Total	
	0-less than 1		1-less than 3		3-less than 5		5 & above			
	Own-ning	Not owning	Own-ing	Not owning	Own-ing	Not owning	Own-ing	Not owning	Own-ing	Not owning
	1	2	3	4	5	6	7	8	9	10
0-less than 5	-	5	1	-	1	-	-	-	2	5
5-less than 10	-	8	3	2	8	-	5	-	16	10
10-less than 15	-	9	1	7	6	-	10	-	17	16
15-less than 20	-	-	-	6	4	4	11	-	15	10
20-less than 30	-	-	-	5	5	3	19	2	24	10
30 and above	-	-	-	1	-	-	22	2	22	3
Total	-	22	5	21	24	7	67	4	96	54

farmers not owning mechanised modes are covered, only 5 per-cent of farmers owning mechanised type of modes are covered by this size-group. In the next size-group of acreage per family labour (i.e., 3-less than 5 acres), the percentage of farmers covered from the former category dwindles down to 13 per cent, that from the latter category rises to 25 per cent. In the highest size-group of acreage per family labour (i.e., 5 acres and above), while the coverage of farmers owning mechanised type of modes is as high as 70 per cent, that of farmers not owning such modes is only 7 per cent.

Influence of ownership right in the well and the area under the command of well on the type of mode employed.

We shall now attempt to analyse the influence of the second set of factors, viz., ownership right in the well and the area under the command of well of a farmer, on the type of mode adopted. It may be stated here that the second set of factors clearly explains the employment of two different types of modes by the same cultivator on his two wells.

Thus, the analysis, besides comparing ownership right in the well and the area irrigated under the wells owned by farmers belonging to two different categories (owning and not owning the mechanised type of mode), also seeks to compare above mentioned parameters in respect of two or more

wells having different types of modes of the cultivators within the first category (i.e., cultivators owning the mechanised type of mode), simultaneously. It may be relevant here to describe the terms, "ownership right in the well" and "area under the command of well".

Ownership right in the well : Ownership right of a farmer in the well determines the period for which the well is at his disposal for drawing water from it. In the village records these rights were stated in the old 'anna' terms where full rights (100 per cent) were equal to 16 annas or a rupee. For convenience sake, we have presented the ownership rights of the farmers in the wells in percentage terms, using the above stated conversion rate.

In such cases where a well was a part of ancestral property, divided and passed on to more than one claimant, the ownership rights of each such claiment in the well was less than 100 per cent. On such wells, a rotation was fixed in which each of the partners, by turn, had access to the well for drawing water. The duration of turn of each partner was in proportion to the right he had in the well. Normally, the period of rotation of turns (the time lag between two turns of each partner) was 7/8 days (on all such wells, fixed once for all, except in cases (which were only 12 in number in respect of our sample) where the relations between the partners

were extremely cordial enabling them to extend or shorten such period depending upon the water requirements of crops. Furthermore, on such wells, besides the duration of the turn of each partner in terms of hours/days being rigidly adhered to, the use of well by each partner on a particular day/days of the week was also strictly complied with. If the turn of a partner 'A' fell on (say) Tuesday and if for any reason (the mode of irrigation being out of order or any such reason) he was not in a position to avail of his turn on that day, then his turn for that week was forfeited.

With these types of arrangements prevailing among the partners of the jointly-owned well in respect of use of well-water, the prospects of their employing individually a mechanised type of mode, particularly an electric motor, on these wells were dampened in view of the following :

(a) During the survey, all the farmers using electric motor reported uncertainty regarding the supply of electricity. The M.S.E.B. took shut-downs of lines more than once a week for carrying out repairs or for giving fresh connections. The farmers invariably reported that they were not in know of these shut-downs except on Sundays. Besides this, due to fluctuations in the voltage, there were interruptions in the smooth operation of motor as the starter tripped off to prevent damage to the motor from the wide fluctuations in the

voltage. Under these circumstances, the apprehensions of cultivators regarding the availability of an individually owned motor for operation on any particular day, on which he has his turn in the well, were quite understandable.

(b) As stated in Chapter IV, minimum consumption guarantee was then stipulated by the M.S.E.B. With the above-stated conditions prevailing regarding the supply of electricity and the limited time at the disposal of farmers for using the individually owned motors on jointly owned wells, they were apprehensive of utilising motors on such wells even to the extent of satisfying minimum consumption guarantee.

(c) The other important factor which weighed against the installation of mechanised mode on such wells by only one of the partners individually for his own use, was the objection by the other partners to such installation. With the larger discharge capacity of mechanised modes and the consequent recession in the water level of the well following the operation of such mode, it was natural to expect objection to the operation of mechanised mode from the other partners of the well using non-mechanised type of lift on the well. The vehemence with which such objections would be raised would, of course, depend upon the rate at which the water-level recuperated itself. In any case, such objections were expected

from the partners of most of such jointly-owned wells, once the steps to install such mode were initiated by any one of them.

In respect of oil engine, such objections of the other partners to its operation by any one of them, could be successfully tackled by its owner by agreeing to avail of his turn only once in two rotations, allowing the other partners to avail of their forsaken turns of the well. Such an arrangement with the other partners of the jointly-owned well, by the owner of electric motor, though not infeasible, could be self-defeating, since it would render the use of motor uneconomical for him with the enforcement of minimum consumption guaratnee. Further, an oil engine being mobile unit could be moved from one well to another.

Area under the command of well : The other factor considered, along with the ownership right in the well, for the analysis of choice of mode of a farmer, is the area of a farmer under the command of a well.

It may be necessary for us to elaborate further the concept of 'area of a farmer under the command of the well', as considered here to be influencing the choice of a mode of a farmer, particularly when the area under the command of a well is not necessarily the same as the net area actually irrigated by a farmer under the well.

In the course of field-survey, each cultivator using sample mode was asked to state his total acreage (mostly contiguous areas of owned land except in a few cases where it consisted of owned plus leased-in land) within the vicinity of the well that could be irrigated by the well-water. Further, he was asked to state the extent of area actually irrigated by him. The difference between the above two viz., irrigable and the actually irrigated was attributed by the cultivators, particularly those using bullock-lift, to one of the following factors :

(A) A part of the plot of land being situated at a higher level so that water could not be channelised with force to that plot;

(B) A part of the plot of land could not be irrigated within the specified period for which the jointly-owned well was at his disposal.

It is to be noted that both of these factors, being related to the force with which the water is drawn (i.e., factor A) and rate of discharge of water (i.e., factor B) could be overcome by a mechanised mode of lift. And, therefore, 'the area under command' is more relevant for considering the potential for a mechanised mode of lift. It is not surprizing that in a none of the 135 wells with mechanised type of mode, it was observed that the part of the area of the farmer

operating such mode was left unirrigated. On the other hand, of the 134 wells having non-mechanised type of mode, in respect of 22 wells, the cultivators with ownership rights, reported that their entire area within the vicinity of the well could not be irrigated by traditional bullock operated lift which they had employed.[1]

As in the case of analysis of socio-economic factors, in respect of analysis of factors under consideration (ownership right and net area under the command of well), not all the cultivators covered by the sample of all 3 modes are considered. As mentioned earlier, these factors seek to explain deployment of two types of mode on two different wells of the same cultivator. Hence, a pre-requisite for such analysis is that the cultivator had full ownership right (100 per cent) in the type of mode employed.

Thus, all 54 cultivators belonging to the category of "owning non-mechanised modes" (included in the analysis of socio-economic factors) have been considered. However, out of 96 cultivators (owning at least one of the mechanised units fully) belonging to the category of "owning mechanised units," 83 cultivators have been considered who had full ownership rights in all the mechanised units they owned.

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1 Out of these 22 cultivators, 6 cultivators mentioned the factor A, stated above, for having been not able to irrigate the entire plot, while 16 others attributed it to the factor B. Further, the average area left unirrigated of these 22 cultivators under the 22 wells was 1.275 acres, ranging between 0.125 acre to as high as 3.225 acres.

Method adopted for studying the influence of second set of factors.

In order to gauge the influence of 'ownership right in the well' and 'area under the command of well' on the type of mode adopted by a farmer, it is essential first, to identify all the wells of the farmers (considered for such analysis) by the type of mode employed (mechanised or non-mechanised) and then to compare these wells over a scaling of the above two parameters.

Furthermore, since we attempt to explain here under an integrated set-up, the employment of different types of modes on the wells belonging to the farmers coming from two categories (owning and not owning mechanised type of wells), as well as deployment of two types of modes by the same farmer on his two or more wells in terms of certain scaling of ownership right in the well and area under the command of well; it is necessary to identify the well in terms of its ownership by the farmer belonging to a particular category.

The scheme of identification of wells, in terms of mode employed on it and ownership by a farmer belonging to a particular category, as devised, is described below :

Let, X denote the well :

Let, X_n and X_m denote the well fitted with non-mechanised type of mode and mechanised type of mode respectively,

both types with full ownership rights.

Let, X^n and X^m denote the wells belonging to a farmer coming the category 'not owning mechanised type of mode' and 'owning mechanised type of mode', respectively.

Thus, X_n^n would indicate a well of a farmer belonging to the category, 'not owning mechanised type of mode' and on which a non-mechanised type of mode is being operated by that farmer.

Similarly, X_m^m would indicate a well of a farmer belonging to the category 'owning mechanised type of mode', wherein he has employed mechanised type of mode; and further X_n^m would indicate a well of a farmer belonging to the category, 'owning mechanised type of mode' but wherein he has employed a non-mechanised type of mode.

Under the above-stated scheme of identification of wells, X_m^n would indicate a well belonging to a farmer from the category, 'not owning mechanised type of mode', but on which mechanised type of mode is employed by him; which is self-contradictory and hence such group of wells cannot exist in our scheme.

Finally, under the above-stated scheme, it is imperative that for the identification of the well, simultaneously in terms of its ownership by a farmer belonging to a particular

category and the type of mode employed on it, only such wells, wherein the mode employed is fully owned by the farmer, be considered. Further, it may be pointed out that when a farmer is considered for this analysis, all the wells in which he has ownership right have to be accounted for. Hence it is obvious that only the wells of the farmers chosen by our above criterion, need be considered for this analysis.

The analysis of influence of second set of factors.

We present in table 8.5 the distribution of wells of 137 farmers (54 farmers in the category, 'not owning mechanised type of mode' and 83 farmers in the category, 'owning mechanised type of mode') in terms of ownership right in the well of the farmer and area under the command of well.

These 137 farmers had ownership rights in 269 wells in all, wherein they had employed, individually, fully owned irrigational modes of different types. Out of these 269 wells, in 97 wells, 54 farmers belonging to the category 'not owning mechanised type of mode', had ownership rights, wherein they operated bullock lift. In the remaining 172 wells, 83 farmers from the category, 'owning mechanised type of mode' had ownership rights. However, not on all these 172 wells, mechanised type of mode was being operated by the farmers of this category. Whereas 57 out of 83 farmers had operated only the mechanised type of mode on 101 wells in which they had ownership rights,

Table 8.5 : Distributions of wells (fitted with mechanised owning mechanised or non-mechanised mode of i in the well and ''net area' under the command

Ownership Right (In percentage)	NET AREA UNDER THE COMMA		
	Less than 1 acre	1 Acre-less than 3 acres	3 acres-
Less than 10	$4^{N}_{N}3^{M}_{N}1^{M}_{M}(1^{M^1}_{M^1})$	$1^{N}_{N}2^{M}_{M}(2^{M^2}_{M^2})$	
10-24	$11^{N}_{N}12^{M}_{N}2^{M}_{M}(2^{M^1}_{M}1)$	$5^{N}_{N}2^{M}_{M}(2^{M^1}_{M^1})$	
25-49	$8^{N}_{N}12^{M}_{N}3^{M}_{M}(3^{M^1}_{M^1})$	$15^{N}_{N}3^{M}_{N}4^{M}_{M}(3^{M^1}_{M^1}1^{M^2}_{M^2})$	$2^{N}_{N}2^{M}_{M}(2^{}$
50-74	$4^{N}_{N}2^{M}_{N}2^{M}_{M}(2^{M^1}_{M^1})$	$10^{N}_{N}1^{M}_{N}6^{M}_{M}(6^{M^1}_{M^1})$	$1^{N}_{N}2^{M}_{M}(:$
75-99	-	$1^{N}_{N}1^{M}_{M}(1^{M^1}_{M^1})$	-
100	$10^{N}_{N}1^{M}_{N}$	$15^{N}_{N}3^{M}_{N}$	8^{M}_{N}
	$5^{M}_{M}(3^{M^1}_{M^1}1^{M^2}_{M^2}1^{M^3}_{M^1})$	$37^{M}_{M}(23^{M^1}_{M^1}9^{M^2}_{M^2}4^{M^3}_{M^1}1^{M^3}_{M^2})$	$28^{M}_{M}(17^{M^1}_{M^1}$
Total	$37^{N}_{N}30^{M}_{N}13^{M}_{M}$ $(11^{M^1}_{M^1}1^{M^2}_{M^2}1^{M^3}_{M^1})$	$47^{N}_{N}7^{M}_{N}52^{M}_{M}$ $(35^{M^1}_{M^1}12^{M^2}_{M^2}4^{M^3}_{M^1}1^{M^3}_{M^2})$	$11^{N}_{N}32^{M}_{M}$ $(21^{M^1}_{M^1}8^{M^2}_{M^2}3^{M}$

Notes : X : Number of wells

X^{M}_{M}: Well fitted with mechanised mode, of a farmer owning mechanised mode.

X^{M}_{N}: Well fitted with non-mechanised mode, of a farmer owning mechanised mode.

X^{N}_{N} : Well fitted with non-mechanised mode, of a farmer owning non-mechanised mode only.

Indicated i

i) $X^{M^1}_{M1}$: Well oil

ii) $X^{M^2}_{M^2}$: Well mod

iii) $X^{M^3}_{M^1}$: W the

iv) $X^{M^3}_{M^2}$: Well both t

each of the remaining 26 farmers had operated both the types of modes - mechanised and non-mechanised - not on the same well but on two or more of his different wells (wherein he had ownership right) so that any one of his wells could be identified as fitted with only one type of mode. Together these 26 farmers had ownership rights in 71 wells in all, of which on 34 wells mechanised type of mode was being operated and on the remaining 37 wells, the non-mechanised type of mode was employed.

Precisely, the phenomena described in the above paragraph, i.e., different types of modes being operated by different farmers, as well as different types of modes being operated by the same farmer, is sought to be explained by classifying these wells over a certain scaling of ownership right in the well of a farmer and area under the command of well, in Table 8.5

Although Table 8.5 seeks to explain, under an integrated set-up, the deployment of different types mode by farmers belonging to two categories (owning and not owning mechanised modes) as also by the farmers within the same category on their two different wells, the influence of underlying factors on the type of mode deployed is not easily perceived due to number of notations used in the table. To facilitate easy perception of influence of ownership right and net area under the command of well on type of mode employed, we present the

Table 8.6 : Percentage of 40 mechanised wells to total wells by ownership rights and net area under the command of wells

Ownership right in the well (In percentage) \ Net area under the command of well	Percentage of mechanised wells to total wells				
	Less than 3 acres	3-5 acres	5-10 acres	10 & above	Total
Less than 25	16.28(7)	-	100.00(1)	-	18.18(8)
25-49	15.56(7)	50.00(2)	50.00(2)	-	20.75(11)
50-74	32.00(8)	66.67(2)	-	-	35.71(10)
75-99	50.00(1)	-	-	-	50.00(1)
100	60.00(42)	77.78(28)	100.00(29)	100.00(6)	73.94(105)
Total	34.95(65)	74.42(32)	194.12(52)	100.00(6)	50.19(135)

Note: Figures in brackets indicate actual number of mechanised wells

percentage of wells covered by mechanised modes in total wells classified on the basis of ownership rights and net area under their command in table 8.6.

The table 8.6 brings out very clearly the influence of ownership rights in the well and net area commanded by the well on type of mode employed by a farmer. For instance, the last column of the table shows gradual increase in percentage of wells covered by mechanised modes (oil engines and electric motors) as the ownership rights of the cultivators in the wells increased. Thus, the percentage of wells covered by mechanised modes in total wells rises from 18.2 for ownership rights in the wells of less than 25 per cent to 35.7 for wells with ownership rights between 50 per cent and 74 per cent. However, this percentage of wells covered by mechanised modes gets doubled (from 35.7% to 73.9%) for the wells with full ownership rights of the cultivators. As mentioned earlier, on jointly-owned wells, the deployment of mechanised modes was constrained due to likely objections from other partners in the well to such an installation due to their higher discharge capacities.

Similarly, the last row of table 8.6 brings out the relationship between the farmer's area under the command of well and his choice for mechanised type of mode. The percentage of wells covered by mechanised modes more than doubles between size-groups of net area under the command of well of less than

3 acres and 3 to 5 acres. Thereafter, it gradually increases to reach 100 per cent for the wells having command areas of 10 acres and above.

Further, we have already observed that factors such as (a) uncertainty in power supply (b) immobility of electric motor (c) system of fixed rotation among the partners of jointly owned-wells constraining the use of motor even to the level of satisfying minimum consumption guarantee, combined themselves to reduce the prospects of electric motor being employed on wells where the cultivator had less than 100 per-cent ownership rights. On the other hand, mobility of oil engines and absence of any stipulation towards minimum level of their operation facilitated their employment even on jointly owned wells and wells with relatively less area under their command. The data in table 8.7 amply bear out the above observations. In table 8.7, we present proportion of wells covered by electric motors to those covered by oil engines in different size-groups of ownership rights and net area under the command of well.

The table 8.7 brings out the higher prospects of deploy-ment of electric motor between two types of mechanised modes on wells having 100 per cent ownership rights of the cultivator vis-a-vis jointly owned wells. As can be seen from the last column of the table, the proportion of wells covered by

Table 8.7 : Proportion of wells covered by electric motor to the wells covered by oil engines in different size-groups of ownership rights and net area commanded by wells.

Ownership rights in the well (In percentage) \ Net area under the command of well (In acres)	Proportion of wells covered by electric motor to those covered by oil engines (in percentage)				
	Less than 3 acres	3-5 acres	5-10 acres	10 & above	Total
Less than 50	17.27 (3)(11)	00.00 (0)(2)	200.00 (2)(1)	-	35.71 (5)(14)
50-74	00.00 (0)(8)	00.00 (0)(2)	-	-	00.00 (0)(10)
75-99	00.00 (0)(1)	-	-	-	00.00 (0)(1)
100	35.48 (11)(31)	64.70 (11)(17)	107.14 (15)(14)	50.00 (2)(4)	59.09 (39)(66)
Total	27.45 (14)(51)	52.35 (11)(21)	113.33 (17)(15)	50.00 (2)(4)	48.35 (44)(91)

Note: Figures in first and second brackets indicate respectively, number of wells covered by electric motor and oil engine.

electric motor to those covered by oil engine which was only 20 per cent for wells having ownership rights of the cultivator's upto 99 per cent rose sharply to nearly 60 per cent for wells having full rights of the cultivators. It may be also observed that number of jointly owned wells covered by electric motors were only 5 , as against 59. fully owned wells covered by them.

Economies obtaining in the operation of electric motor vis-a-vis oil engines are also brought out by the above table with the proportion of wells covered by electric motors to those covered by oil engines rising with increase in areas under the command of wells. Thus, proportion of wells covered by electric motors to those covered by engines rises from 27.5% for wells having command area of less than 3 acres to 52.4% for wells with command area of 3 to 5 acres and further to 100 per cent for wells with command area of over 5 acres.

The preference for oil engine on jointly-owned wells may be further seen from the following:

(a) Out of 25 jointly-owned wells covered by oil engines as stated in above table, in respect of 21 such wells, the engine employed was not solely meant for the operation on any one of them. In other words, the engine employed there was moved on to other such jointly-owned wells or to fully owned well of the cultivator.

(b) Out of 25 jointly owned wells, in respect of 20 wells, the number of hours of operation of engine during the entire year was less than 75 hours each. Of the remaining 5 wells, in respect of 4 wells, hours of operation of engine were less than 200 hours each during the year 1965-66, with only in respect of one well, it was to the extent of 430 hours.

Thus, use of electric motor would have been uneconomical on these wells since, in most cases, the consumption of electricity would have been much below the level stipulated by minimum consumption guarantee. In fact, 4 out of 5 electric motors installed on jointly owned wells (as mentioned in table 8.7) could not be operated even to the level fulfiling minimum consumption guarantee.

Joint ownership of mechanised modes

A word may be said here about the sharing of the ownership of mechanised modes (on the jointly-owned wells) indicating inter alia, which one of the two types of mechanised modes was being shared more frequently by the farmers and whether any intrinsic qualities of the particular mode were responsible for such tendency being observed.

As stated earlier, 75 electric motors and 65 oil engines were covered in the sample of irrigation-modes for the computation of cost of irrigation by different modes. It is to be

noted that whereas 29 out of 75 motors were observed to be jointly-owned, only 9 out of 65 engines were shared by the partners. Thus the tendency of joint ownership was stronger in the case of electric motors (38.67 per cent) as compared to that in respect of oil engines (13.85 per cent). It may be also observed that in respect of 8 out of these 9 oil engines, the number of partners sharing each one of them was less than 6 and further for 6 out of these 8 engines, the number of partners was only 3 or less. Lastly, it is significant to note that excepting one, in the case of remaining 8 engines, the partners of the engines were closely related to each other, i.e., the partnership was either between first brothers or cousins or uncle and nephews. In comparison to relatively 'close' partnership of oil engines, as described above, the partnership of electric motor was more''open' which can be seen from the following.

Out of 29 jointly-owned motors, the ownership of 11 motors was shared among 6 or more partners in each case, for another 10 motors, the number of partners was either 4 or 5 leaving only 8 motors with the partnership restricted to a number less than 4, i.e., 2 or 3. Furthermore, it may be observed that in respect of each of 18 out of these 29 jointly-owned motors, there was at least one partner

who was in no way related to the other partners. Finally, it is interesting to note that in spite of the above-mentioned 'diffused ownership' of electric motors, the relations between the partners of the motors were observed to be more cordial as compared to the relations between the partners of jointly-owned engines.[1] It might be, therefore, worthwhile to discuss in more detail the different practices followed in sharing of operational and maintenance cost of sample engines and motors by the joint--owners of these modes which led to the above-mentioned divergent trends.

Practices of sharing the cost of operation of engines and motors among the partners : The engine requiring both lubricant oil and diesel but particularly the latter for its daily operation, the ideal thing to avoid any discord on sharing of cost of diesel would have been that each partner after his use should keep the diesel tank full for the use of the partner having his turn next. Unfortunately, this was not the practice being followed by the partners of the jointly-owned,

1 None of the partners (who was respondent) of the 29 jointly-owned motors, included in the sample, complained that he was being exploited by the other partners, individually or jointly, or stated that his use of the motor, when compared to the uses of motor by the other partner, was less than proportional to the ownership rights he had in the motor. Similarly, none of these partners complained that the energy bill he paid as compared to the bills paid by the other partners of the motor, was disproportionately high in relation to his use of the motor/ ownership right in the motor. On the other hand, the partners of 3 jointly-owned enginesout of 9 included in the sample, grumbled that the maintenance expenses they shared were disproportionately high as compared to their ownership rights and hence they had mind to discontinue the partnership.

engines in the sample. The common practice was that each of the partners would use his own diesel and would attempt to empty the tank at the end of his use. However, while filling in the tank, it was not always possible for the farmer to have precise judgement on his requirement of diesel, thus resulting in some diesel being left in the tank at the end of his use. In such cases, the farmer expected payment for the left-over diesel in the tank from the farmer having his turn next. Bargaining on the value of the left-over diesel or delay in its payment led to rift among the partners of engine. Further, as stated earlier, the engine also required lubricant oil for its operation which had to be replaced at the interval of about 200 hours of use of engine. Although the general practice was to share the cost of lubricant oil in proportion to ownership rights in the engine, it was decided that the tin of lubricant oil would be purchased in rotation by the partners. The delay in purchase of tin of lubricant oil by any one of the partners when the other felt that the engine-oil was overdue for replacement, caused strained relations between the partners.

On the other hand, in respect of an electric motor, no diesel or oil had to be purchased for its daily operation. All that was necessary was the prompt payment of their respective shares of electricity bills every month by all the partners individually, so as to enable them to remit the total

amount to the Board within the specified period. In respect of all the jointly-owned electric motors included in the sample, it was tacitly agreed upon that if a particular partner did not pay the bill within a specified date every month, he would not be allowed to utilise the motor during his turns for such time till he paid of the bill. For this reason and for the fact that on an average the monthly incidence of energy bills was never more than Rs.25/- per partner (for 23 partners of the 23 out of 29 jointly-owned motors, the monthly bill worked out to be even less than Rs.10/-), there was no problem of electricity bills being delayed by them individually. As far as the apportionment of electricity bills between different partners, there was an agreement between the partners that the bills would be shared in proportion to their ownership rights. In respect of 26 jointly-owned motors out of 29 such motors, the above-stated agreement was in force. In thecase of remaining 3 motors, the cultivators shared the bills on the basis of actual units recorded during their turns on the meter.

It may be recalled here that we have estimated the total number of hours for which the motor was operated by the farmer, independently of units recorded on meter, by collecting data on the cropping pattern under the command of well wherein the motor was installed, the number of irrigations given to the cropsand the duration of pump operated for each irrigation etc.

It is interesting to note that the estimate of hours of operation of motor by the farmer, based on the information elicited on number of irrigations, cropping pattern etc., compares favourably with the estimate of hours of operation of motor for which he had actually paid the bill, i.e., hours derived from the total units recorded on meter and apportioned to the farmer according to his ownership rights.

However, we could not probe deeper into the causative factors leading to this phenomenon, i.e., estimate of hours of operation of motor according to farmer (partner of motor) as per the number of irrigations he had given to the crops approximating closely with the hours for which he had paid the bills; particularly when the power-supply interrupted the operation of an electric motor quite often. Suffice to note that all these jointly-owned motors were operated.[1] by the 'senior partners' (the partners who had initiated steps to install the respective motors and in whose name the motors stood in the records of M.S.E.B.) respectively, and in each case the turn of a partner was defined in terms of number of hours of operation for irrigating his plot of land. The daily timings of operation of motor were also fixed, viz., 4 hours in the morning and 4 hours in the afternoon, relaxable under exceptionable circumstances such as power-failure etc.

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1 The switch-board for starting the motor was kept under the lock and key, in possession of senior partner of the motor. Everyday this particular farmer switched on and off the motor at appointed hours.

Whatever be the terms and conditions of operation of jointly-owned motor as agreed upon by its partners, it is pertinent to note that none of the partners of the 26 jointly-owned motors. were sharing the bill on the basis of ownership rights, complained that, payment of electricity charges in relation to their use of motor was desproportionately high as compared to the charges paid by the other partners vis-a-vis their uses of motor.

This is not to say that all was well with the operation of jointly-owned motors by its partners. Each of the 10 out of these 25 jointly-owned motors having 4 or more partners, were operated by all the partners together for only 500 hours during the entire year.

As stated earlier, we had contacted only one farmer for every jointly-owned motor. The analyses of cropping patterns of these 10 different farmers having ownership rights in the aforesaid 10 jointly-owned motors revealed that the crops grown on the plot irrigated bymotor were mainly cereals like Rabi jowar, wheat, gram, maize whose water requirements are low.[1] Only 4 out of these 10 farmers had reported acreage (each reporting less than 0.250 acre) under crops like potato, chillies, onion whose water requirements are moderately high.[2]

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1 These crops require irrigation once in two/three weeks and 3 to 4 irrigations in all.

2 These crops require weekly irrigation and about 11 to 14 irrigations in all.

None of these farmers had reported highly irrigated crops such as sugarcane, lucerne grass, betel leaves, grapes, etc. requiring irrigation every 7-10 days almost throughout the year. Confronted with a question seeking reasons for concentrating mainly on cereals even after mechanisation of wells, these cultivators stated that the uncertainty in supply of power forced them to go in for such crops whose water requirements they were sure to meet, particularly when the motor was jointly-owned with each partner having his turn on the fixed day. Bringing about improvement in the conditions of power-supply in rural areas would certainly help the M.S.E.B. to augment its revenues on rural lines.

Practices of sharing the cost of maintenance of sample engines and motors : Two important features regarding the maintenance of engine, brought out in the Chapter V, may be recalled here. At the time of annual overhauling, some parts of the engine, such as liner or piston or valve packet or bearings or nozzle, had to be replaced. Hence the annual servicing cost of engine was higher as compared to that of motor, in absolute terms. Further, we had also brought out in the chapter, the relationship between the maintenance cost of engine and the quality of fuel used, viz., lower the quality of fuel used, higher was the maintenance cost. With the above-stated conditions obtaining in the maintenance of oil-engine and every partner buying his

own fuel, the general tendency among the partners was to apportion the blame of high replacement cost of spare-parts on the other partners, on plea of their use of low cost fuel or delay in replacing the engine oil, so that its incidence could be passed on to other partners. In this race of shifting the burden to others, sometimes the most needy farmer had to pay off the entire cost initially from his pocket which was even difficult to be recovered, at times, from others. In respect of 3 out of the 9 jointly-owned engines in the sample, similar incidents, as narrated above, had taken place resulting in Rs.399, Rs.140 and Rs.55/- of servicing cost being borne respectively by 3 partners singly as the other partners having ownership rights refused to bear the cost on the above-mentioned pleas. These three farmers were, therefore, contemplating to break out of partnership, as stated earlier.

In respect of motor, the annual servicing did not invite large expenditure (ranging between Rs.15/- to Rs.25/-), since it did not involve replacement of any major part as in the case of an engine. Generally, the annual overhauling was limited to cleaning and greasing the motor and the pump with some minor repairs of pump and starter. Thus there was no difficulty in obtaining the contributions from the partners of the motors towards these expenses, since the amount involved was not much, when apportioned among the partners.

However, the electric motors also gave an occasion, though not at regular intervals, for major replacements of the parts, i.e., rewinding of coils, costing about Rs.200 to Rs.300, when they were burnt due to wide fluctuations in the voltage of electricity. As stated in the earlier chapter, a device known as starter was provided to prevent any damage to the motor arising out of fluctuations in the voltage. Sometimes the mechanism of starter failed or sometimes, as mentioned in chapter IV, the cultivators themselves prevented the starter to trip off which resulted in the burning of coils of the motor.

In respect of 11 out of 29 jointly-owned motors, an expenditure was incurred on rewinding of coils of which in the case of 10 motors, it was shared by their respective partners.For the remaining 1 motor, the expenditure was entirely borne by a single partner alone, since it was found that he had deliberately tied the handle of the starter so as to prevent it from tripping off which resulted in burning of coil of the motor. The remaining 10 motors, though burnt during the turn of their partners, the repairing costs were proportionately shared by all the partners, perhaps because (a) there was no evidence to establish that the occurrence of phenomenon was due to deliberate and faulty method adopted by the partners during whose turn these motors were burnt; and (b) the other

partners were perhaps not ready to shirk off the responsibility of sharing the cost, as in the case of partners of oil-engine, since the accident could as well occur during their turns on the motor, in the future.

All these things apart, having been convinced of the economies in the operation of electric motor, the partners were reluctant to break off the partnership merely because they had to share the above-mentioned repairing cost, once in a way. Nor the 'senior partner's was perhaps prepared to encourage the unhealthy trend of burdening only one of the partners with the repairing cost, every time the coils burnt, fearing that it would result in agrieved partners breaking off the partnership, thus rendering the use of motor uneconomical for him ultimately.

In view of the wide fluctuations in the voltage of electricity resulting in the damages to the motors, it may be worthwhile to popularise the insurance scheme for the electric motors with accident benefits so as to encourage the use of electricity for irrigational purposes.

Thus, on a jointly-owned well, between the 2 types of mechanised modes, i.e., electric motor and oil-engine, the chances of an engine being installed are more vis-a-vis electric motor if it is going to be individually owned installation. But

in respect of jointly-owned installations on such wells, the chances for thriving of partnership are better for an electric motor as compared to an oil engine.

Shift from Oil Engine to Electric Motor

It may be mentioned here that besides the ownership right in the well and the area under the command of well, there were other factors which influenced the decision of a farmer using oil engine, in an electrified village, to switch over to electric motor. The analysis of these factors becomesall the more necessary since, as mentioned in chapter II, one of the criteria adopted by the M.S.E.B. for the selection of a village for its electrification, was the number of oil engines existing in the village.

We have, therefore, attempted below the analysis of such factors that influence or prohibit the cultivators using oil engines to change over to electricity, in the electrified villages. The analysis is confined to the sample of oil engines which was selected for the purpose of estimating the cost of irrigation by this type of mode. The reason for limiting the analysis to only sample number of engines, as stated above, is that the cultivators operating these engines were posed with a specific querry whether they were contemplating to shift over to an electric motor, in the near future. Furthermore, these cultivators were asked to state the reasons for

their answers to the above stated querry. It was possible to verify the validity of such answers in these cases, since the data on cost of irrigation by the engine, the age of engine, the level of operations of engine etc., were collected in respect of them.

In table 8.8, we present the details (in terms of types of modes owned) of the cultivators owning sample number of oil engines (65 in total).

Table 8.8 : Distribution of ownership of sample number of oil engines by the cultivators classified on the basis of types of mode owned by them.

Category of cultivators (Based on the types of modes owned)@	No.of cultivators in the category	No.of sample engines covered by the cultivators of the category
I. Owning only oil engine of which -		
(a) Owning less than unit	9	9
(b) Owning exactly a unit	32	32
(c) Owning more than a unit	5	10
II. Owning Engine & Motor of which -		
(a) Owning engine fully but motor partly.	2	2
(b) Owning engine and motor both fully.	3	3
III. Owning Engine & Bullock lift.	7	7
IV. Owning Engine, Motor and Bullock lift	2	2
Total	60	65

Note: @ The categories of cultivators enumerated in this table are the same as those mentioned in Table 8.1.

As stated earlier, each of these 60 cultivators were asked to state whether they were likely to switch over to electricity and if so, whether in the process of switching over, they were likely to dispose off the oil engine, i.e., present mode of irrigation. The responses to these querries are given in table 8.9. The identity of the cultivators, in terms of categories based on their ownership pattern of irrigational modes, is maintained while presenting their responses. It may be further observed that in table 8.9, the response in effirmative to the querry, 'whether switching over to electricity', has been further divided into two groups, i.e., already applied for electricity and likely to apply for electricity, in accordance with the actual replies received for it. It may be also noted that in respect of the reply, 'likely to apply for electricity', the time-dimension is rather vague.

In spite of the known economies in the operation and maintenance of an electric motor vis-a-vis an oil engine, it is interesting to note from the table that the owner-cultivators of 41 out of a sample of 65 engines or 63 per cent of sample number of engines, were reluctant to switch over to an electric motor from an engine. On the other hand, although 20 cultivators owning 24 engines were prepared to switch over to an electric motor, 4 out of these were to retain their 4 engines even after switching over to electricity. Thus, at the

Table 8.9 : Distribution of cultivators owning sample oil engines on the response to the querry of switching over to electricity and the number of sample oil engines likely to be replaced in the event of their switch over.

Category of cultivators (based on types of modes owned)	Cultivators opting for electricity (of which)				Cultivators not opting for electricity		Total	
	Already applied for connection		Likely to Apply					
	No.of cultivators	No.of sample engines covered	No.of cultivators	No.of sample engines covered	No.of cultivators	No.of sample engines covered	No.of cultivators	No.of sample engines covered
	1	2	3	4	5	6	7	8
I. Owning only oil engine of whih -								
(a) Owning less than a unit	1	1	1	1	7	7	9	9
(b) Owning exactly a unit	5	5	6	6	21	21	32	32
(c) Owning more than a unit	4	8(4)	-	-	1	2	5	10
II. Owning Engine & Motor of which -								
(a) Owning engine fully but motor partly	-	-	-	-	2	2	2	2
(b) Owning engine and motor both fully	-	-	-	-	3	3	3	3
III. Owning engine and bullock-lift	3	3	-	-	4	4	7	7
IV. Owning engine, motor & bullock-lift	-	-	-	-	2	2	2	2
Total	13	17(4)	7	7	40	41	60	65

Note: In column 2, the figures in brackets indicate the number of engines likely to be retained by the cultivators even after switching to electricity.

aggregative level, only less than one third of sample number of engines (20 out of 65) were likely to be replaced by an electric motor.

We shall, therefore, discuss the causative factors stated by the cultivators for the above-mentioned phenomenon, in the following :

Broadly speaking, the following five reasons were given by the cultivators for not switching over to electricity (a) uncertainty in electricity supply (b) oil engine being used on more than one well and, therefore, more economical (c) not having rights to dispose of the engine (d) earning income through hiring out the engine, and (e) level of utilisation of engine being low. Table 8.10 shows the distribution of cultivators and the engines covered by these five categories of answers . Since some of the cultivators gave more than one reason for not shifting to electricity, the number of cultivators in each cell of the table is overlapping.

Table 8.10 : Distribution of cultivators and number of oil engines covered by reasons for not shifting to electricity.

Reason	No.of cultivators stating the reason	No.of engines covered by the cultivators
(a) Uncertainty in electric supply	7	7
(b) Oil engine being used on more than one well	21	21
(c) Lack of disposing rights in the engine	27	27
(d) Earning income through hiring the engine	1	1
(e) Low level of utilisation of engine	8	9

It can be observed from table 8.10 that interplay of non-economic factors (covered by category 'a' and 'c') was stronger than economic factors (covered by category 'b', 'd' and 'e') in preventing the cultivators from switching over to electricity. It may be noted here that reason 'a' was ascribed by the cultivators owning electric motors besides oil engine (categories II and IV of table 8.9), thus having the experience of frequent shut-downs of M.S.E.B. As regards the reason 'c', it was reported by the cultivators financing engines out of borrowed source (institutional finance) and having paid less than 7 repayment instalments. On the other hand, some of the cultivators (6 in total) who had repaid 7/8 instalments were agreeable to switch over but could not state the exact period when they would be shifting to electricity and hence are covered by the category 'likely to apply' in table 8.9. In the context of 27 cultivators reporting lack of disposing rights as reason for not switching over to electricity, it would be worthwhile to describe conditions of loans from institutional sources.

In respect of engines financed out of loans from institutional sources being mortgaged with the institutions till the loan amount was entirely repaid (repayment period being 10 years), the owner had no right to dispose of the engine for ten years, or such period till the loan amount was cleared.

In this connection, it is worthwhile to observe that in the application form for the loan to the Land Development Bank, the cultivator had to state the number of wells wherein the engine would be employed, the areas likely to be irrigated under such wells, etc. from which the repayment capacity of the cultivator was ascertained.

With the rigid rules in force in regard to disposing of engine financed through institutional sources and the remote possibility of such engine being disposed of within near future from installation in view of the long-drawn repayment schedule, it is necessary that these institutions should verify from the Electricity Board's sub-offices, particularly in respect of such engines which are to be operated on only one well, whether such wells are likely to be covered by the lines of the Board in near future. Similarly, they should think in terms of waiver of the rules concerning disposal of engine in such cases wherein the cultivators are desirous of switching over to electricity and thus want to dispose them of, provided the cultivator would mortgage the motor with them till such time the entire loan originally obtained for the engine is fully repaid.

The above-mentioned suggestions have relevence to our data which show that as many as 14 engines financed out of institutional sources and not likely to be replaced were

installed after the electrification of the villages. In respect of 4 out of these 14 engines the distribution lines of the Board went past wells (wherein engines were operated) within 6 months of the installation of engine. It is to be noted that 2 out of these 4 engines were operated for more than 600 hours each with one of the remaining two being operated for around 500 hours and the other around 400 hours. In the absence of rigid rules governing the disposition of engines financed out of borrowed funds, these cultivators might have shifted to electricity.

In the context of mobility of engine being stated as the reason for not switching over in respect of 21 oil engines, it may be relevant to present operational details of the engines. Table 8.11 shows such details as total hours of operation of engine during 1965-66, number of wells on which the engines were operated and minima, maxima range of hours operated on different wells.

It can be observed from the Table 8.11 that in respect of some of these 21 oil engines, switch-over to electricity would have been an economic proposition since the maximum hours of operation of engine obtaining in certain wells would have yielded considerable economies for the cultivator after the shift. However, the cultivators would have had to raise finance

Table 8.11 : Details of employment of mobile engines not likely to be replaced by electricity.

No.of wells on which engine operated \ Total hours of operation in the year (size-group)	Number of oil engines						
	Less than 100	100-300	300-500	500-700	700-1000	1000 & above	Total
2	1(27,34) 1(28,47) 1(25,72)	1(89,149) 1(24,206)	1(20, 288)	1(126, 376) 1(246, 381)	-	-	8
3	1(10,44)	1(2,160) 1(67,68)	1(62,88) 1(23,320)	-	1(219,332) 1(32,474)	-	7
4	-	1(10,132)	-	-	-	-	1
5	1(-	1(14,90)	1(79,268)	-	-	-	2
6	-	-	1(18,214)	-	-	1(24,480) 1(49,352)	3
Total	4	6	5	2	2	2	21

Note: Figures in brackets indicate minima-maxima of hours of operation.

for installation of electric motors, since oil engines could not be disposed of, being utilised on other wells. However, these cultivators had either not thought of it or they had no idea about the relative economies of oil engine and electric motor, as can be seen from the following discussion.

Farmers' Concept of Relative Economies of Electric Motor

The cultivators who got selected for the use of engine, before being questioned regarding their intentions of switching over to electricity, were asked whether they had any idea about the economies involved in the operation of these two modes (oil engine and electric motor); and further, if so, at what level of operation.[1]

All the 60 cultivators operating 65 sample engines stated that they had an idea about the resulting cost-economies in operation of motor in relation to an oil-engine. However, the responses to further querries were quite interesting. 20 out of these 60 cultivators could not state the extent of economies involved in the operation of electric motor vis-a-vis, oil-

1 In other words, an attempt was made to find out whether the cultivators owning engines were aware of the minimum consumption guarantee which was in force regarding the use of motor and its implications for utilisation of motor in terms of minimum number of hours in a year so as to derive benefits through reduction in the cost of irrigation by motor vis-a-vis the cost of irrigation by an oil engine.

engine even in terms of cost per hour of operation. Thus the notion of these 20 cultivators or an electric motor being less expensive as compared to oil-engine was extremely hazy.

Although each of the remaining 40 cultivators seemed to be aware of the economies involved in the operation of motor vis-a-vis an engine, in terms of comparison of operational cost on hourly basis, not all of them appeared to have known the minimum consumption guarantee stipulated by the M.S.E.B. in respect of use of motor which invalidated the application of any simple formula, based on difference in per-hour operational cost of these two modes to arrive at total reduction in cost of operation, at different levels of operation of electric motor. 31 out of these 40 farmers knew exactly the terms of the minimum consumption guarantee limit for 5 HP electric motor, being Rs.200 per annum. However, it is to be noted that the operational significance of the 'minimum consumption guarantee' as an indicator of the level of operationof motor beyond which the economics in its utilisation could be realised, was not very clear with these cultivators. 9 out of these 31 cultivators stated that 250 hours were the minimum number of hours for which the motor must be used so that the annual bill is beyond the guarantee limit and the economics pertaining to reduction of operational costs vis-a-vis those of engine are realised. It may be observed here that 7 out of

these 9 cultivators were those who had an electric motor besides oil engine. The remaining 22 farmers' notion about the significance of the minimum consumption guarantee to derive the break-even point of utilisation of motor, in terms of number of hours, for the accrual of economies in its operation, was quite 'inflated' in comparison to the above-mentioned 9 cultivators. 10 out of these 22 cultivators thought that 600 hours of annual operation of motor was required to realise the economies in its utilisation while the other 12 considered it to be 475 to 500 hours.[1] What is important to note here is the misnomer in the minds of cultivators who were aware of the minimum consumption guarantee that the use of motor was economical only beyond the point where the minimum consumption guarantee was fulfilled.

Under the circumstances, to popularise the use of electricity in rural areas, particularly for irrigational purposes, it was extremely necessary on the part of the M.S.E.B. to propagate vigorously the advantages of use of electricity

1 These total number of hours were arrived as under : 10 cultivators stated that at least 5 hours of daily working of motor was required during 4 months of Rabi season (November, December, January, February) so that minimum consumption guarantee limit be reached. Similarly, the other 12 cultivators stated as 4 hours of daily operation during the 4 months of Rabi season was required to fulfill the minimum consumption guarantee limit. The emphasis on Rabi season for the effective use of motor was perhaps due to the fact that during Kharif season it was thought that the motor might not be required to be operated daily, and in summer, the continuous use of motor was thought to be less probable in view of lack of availability of water in the well.

with an emphasis on the following points :

(a) Bringing out the differencesin the costs of these two modes at different levels of operation, considering only the operational costs (fuel cost for engine and electricity charges for motor) of the modes and also indicating exactly the implications of minimum consumption guarantee in terms of number of hours of operation of electric motor so that (i) no ambiguity is left in the minds of cultivators as regards the number of hours of operation of motor required tofulfill the minimum consumption guarantee and (ii) toremove misnomer that the use of motor is economical vis-a-vis engine only beyond the point (number of hours) of satisfaction of the minimum consumption guarantee.

(b) Also bringing out the cost of maintenance of these 2 modes at different levels of operation, particularly such levels which fall within the point of fulfilment of minimum consumption guarantee for electric motor, so that economies in the cost of operation of motor as compared to engine upto the level of satisfaction of the minimum consumption guarantee are well brought out.

Village-wise installationof Engine with respect to date of electrification of village.

As stated in Chapter II, one of the criteria for the selection of a village for electrification was the number of

oil engines existing in the village. In this context, it may be relevant here to present the distribution of sample engines village-wise and within village, its further distribution showing the number of engines installed before electrification of the village and the number installed after electrification. Further, for each of the above categories of sample engines, installed with respect to date of electrification of village, its break-up giving number of engines likely to be retained and likely to be replaced, is also presented in the Table 8.12. Since the information presented in the table relates to year of survey, it would indicate, though in a limited way, the time dimension involved for converting the engines existing at the time of electrification of the village into an electrically operated motor.

As can be observed from the table, the proportion of engines likely to be replaced, is relatively higher among the category of engines installed before the electrification of villages as compared to those in the category of engines installed after electrification of villages. The proportion of engines likely to be replaced works out as 39.6 per cent in the former category and 5.9 per cent in the latter category. Since the table reveals the data on the above parameter at a point of time (as the position stood at the time of survey, i.e., in the year 1966-67), the above findings are quite

Table 8.12 : Village-wise distribution of engines-installed before and after electrification of the village classified under the heads 'likely to be retained' and 'likely to be replaced'.

Name of the village	Date of Electrification	No.of sample engines of which			Engines installed before electrification of the village			Engines installed after electrification of the village		
		Total	Installed before electrification	Installed after electrification	Total	Likely to be retained	Likely to be replaced	Total	Likely to be retained	Likely to be replaced
1	2	3	4	5	6	7	8	9	10	11
1. Chikhali	27-6-60	6	4	2	4	-	4	2	1	1
2. Phursungi	11-12-61	7	6	1	6	2	4	1	1	-
3. Shivari	26-1-62	9	4	5	4	2	2	5	5	-
4. Mahalunge	30-1-62	7	5	2	5	4	1	2	2	-
5. Dawadi	30-6-62	1	-	1	-	-	-	1	1	-
6. Narayangaon	16-12-62	6	5	1	5	4	1	1	1	-
7. Walunj	21-10-63	7	4	3	4	3	1	3	3	-
8. Retawadi	26-1-64	4	4	-	4	4	-	-	-	-
9. Ranjangaon	29-2-64	13	11	2	11	5	6	2	2	-
10. Shinoli	26-1-65	5	5	-	5	5	-	-	-	-
Total		65	48	17	48	29	19	17	16	1

in order since the engines in the former category were relatively older as compared to the engines in the latter category, at the time of survey. For the same reason, within the former category of engines, installed before electrification of village, the proportion of engines likely to be replaced, dwindles down for the villages whose dates of electrification were nearer to the year of survey.

For example, in the village Chikhali, electrified in the year 1960, the owner-cultivators of all the 4 engines installed before the electrification stated that they were likely to replace their engines with motor, at the time of survey. However, in the villages Phursungi, Narayangaon, Walunj, Shivari and Mahalunge electrified during the year 1961 and 1962 and 1963, only 9 engines out of 24 engines in the above-stated category (i.e., installed before electrification of village) were found as likely to be replaced, thus giving a proportion of 37.5 per cent of engines of the aforesaid category. In the last group of villages, i.e., Retawadi, Ranjangaon and Shinoli electrified during the year 1964 and 1965, it can be seen that the proportion of engines likely to be replaced within the above-stated category, is 30.00 percent (6 out of 20).

It is relevant to note here that except in the village Chikhali, electrified in 1960, in all other villages, the

proportion of sample number of engines installed before the electrification of a village and likely to be replaced is less than 70 per cent. The proportion of engines likely to be replaced out of total engines, installed before electrification of a village, range between 66.7 per cent in the village Phursungi which had completed almost 5 years of electrification and 'nil' in the village Shinoli which had completed one year of electrification, at the time of survey. Thus, it can be stated that the criterian of potentialities of irrigational use of electricity in a village, as adjudged by the M.S.E.B. in terms of the village having at least 10 oil-engines, for its electrification, was in itself perfectly valid one, it did not imply that all the existing engines in the village at the time of its electrification would be replaced by electricity, in a short span of time, once the lines were laid in the village. On the other hand, it is quite significant to note that over 25 per cent of the sample number of engines (17 out of 65) were such that they were installed in these villages after their electrification. It might be, therefore, suggested that it is extremely necessary for the village-level officials of M.S.E.B. to maintain continuous rapport with the villages even after their electrification so that the farmers going in for oil engines could be brought within the fold of electricity, if possible, thus augmenting the revenues of the M.S.E.B.

Analysis of time-lag in connection of electricity for the farmers using motors

It is important to analyse the time-dimension involved and the factors responsible therefore, in the development of use of electricity for irrigational purposes since much importance was attached to irrigational use of electricity in the selection of village for electrification. This has been attempted here from sample of electric motors connected at different time-intervals with respect to date of electrification of village.

Before we proceed further, it is relevant here to describe the procedure adopted by the M.S.E.B. in granting connection to the pumpsets which would elaborate the concept of time-lag sought to be analysed.

Procedure followed by M.S.E.B. for energisation of pumpsets : It is well-known that in a village, generally the place of inhabitance and the agricultural fields are not one and the same, being situated apart with the former place being known as 'Gaothan' in Maharashtra. In the circumstances, given the technicalities involved in the distribution of electricity, the electrification of two places, i.e., Gaothan and fields (pumpsets), could be two different propositions depending upon the distance between the two.

As stated earlier, the M.S.E.B. stipulated that power would not be granted to any single consumer but to a group of consumers provided the group satisfies the norm of 15 per cent revenue return over the total cost of distribution of power.

Further, even if a village was selected for electrification, what part of the village (Gaothan or agricultural fields) would get precedence in electrification would depend upon the topography of the village vis-a-vis the route of the main transmission line passing through the area. Thus speaking, if the 'Gaothan' was nearer to the transmission line than the fields, it might get precedence or vice-versa. Sometimes, the electrification of one of the parts became a necessary condition for the electrification of the other in view of the prescribed condition of securing 15 per cent revenue return over the cost of electrification of the area. It may be noted here that the dichotomy of the electrification of place of habitance and fields need not be as sacrosant as described above. Depending upon the distance between the two parts, the willingness of the farmers whose wells were on the periphery of the 'Gaothan' to go for electricity, the technicalities involved in the distribution (such as capacity of transformer, the distance between the farthest consumption point and the transformer, etc.) and the satisfaction of the prescribed formula of 15 per cent revenue return, a scheme combining the

electrification of 'Gaothan' as well as fields was also considered.

Further, the procedure followed by the M.S.E.B. in sanctioning of a scheme need be described for the purpose of explaining the concept of time-lag as adopted by us.

To render firmness to the estimates of cost and return on any scheme for commencing construction, security deposit was accepted and undertaking was taken from the following types of consumers that they would avail of the supply of electricity for the period of seven years, agreeing to pay the minimum consumption guarantee, at least -

(a) consumers for irrigational purpose;

(b) consumer for industrial purpose like flour mill, rice mill etc.;

(c) using electricity for street lighting purpose (in this case the undertaking is taken from Gram Panchayat of the village).

It became extremely essential to have the undertaking from the consumers desirous of using electricity for the purpose of (a) above, in view of the scattered nature of consumption points (agricultural wells), and hence the possibility of ensuing waste if the consumers were to back out after the lines were laid. Thus, the scheme, which was no

more than a feasibility study at the stage when the load survey was conducted, achieved a definite shape after security deposits were paid by the consumers. This was particularly true of schemes for energisation of pumpsets.

In view of the above-mentioned description of the procedure followed by the M.S.E.B. in the electrification of rural areas, the time-lag in the energisation of pumpsets could occur at two stages as given below :

(a) Delay in connection of pumpset could occur because the construction work on the scheme being delayed for want of 'effective' number of cultivators coming and paying security deposits which would make the scheme economically viable, i.e., fetching 15 per cent revenue to the M.S.E.B. over the cost involved. In other words, this delay portrays the gap between the two points of time, i.e., the time when the initial load survey is conducted and the time when the scheme was taken up for construction.

(b) Delay in connection of pumpset could also occur even after lines were laid due to the farmer not availing of supply because the electric motor could not be installed in time. Such a delay in installation could be due to non-availability of finance, inability to dispose of the previous mode such as oil engine through which finance was to be raised for installation of motor, etc.

Availability of data on time-lag : Thus the factors responsible for time-lag in connection could be both, exogenous and endogenous, from the individual farmer's point of view. While the analysis of the endogenous factors as described in (b) above could be made by eliciting information from the respondents themselves, the reasons for time-lag due to factors given in (a) above, had to be collected from the record of the M.S.E.B. Further, on the accuracy of information on one of the parameters for estimating time-lag considered in (a), namely, the date of completion of construction work of a scheme, depended the estimate of time-lag considered in (b) for individual pump-set connected under the scheme. Unfortunately, accurate data was not available with the offices of M.S.E.B. which could portray the time-lapsed between different stages of a scheme for energisation of pump-sets such as the initial step of load survey, followed by completion of formalities (payment of security deposit, entering into an agreement with the M.S.E.B. for availment of supply for 7 years), commencement of construction work, and finally, the last stage of completion of work leading to connection of pumpsets. Under the circumstances, we have adopted the following method and made the following assumptions for the estimation of time-lag.

As a back-drop to the assumptions made, it may be relevant here to describe the role played by local leaders in

the spread of electricity, particularly for irrigation purposes.

Role of local leaders : In every village there were some emancipated farmers who were quite conversant with the advantages of an electricity-driven pump vis-a-vis other modes, because of their connection with the electrified towns or due to reading of Newspapers etc. In fact, in all the sample villages, it was observed that such farmers/local leaders had taken the initiative in applying for energisation of pumpsets. The Load Survey Unit of the M.S.E.B., not having much of a locus standi in the village, in those years, had to depend on such farmers/local leaders for moving around in the village to assess the potential for the development of use of electricity.

Thus in the village Phursungi, there were two farmers - one an agricultural graduate, another a teacher in an agricultural school - responsible respectively, for 2 separate schemes, under which the then existing motors were connected. Similarly, in the village Chikhali, a retired army-personnel who was also the 'Sarpanch'[1] had taken initiative in getting the scheme sanctioned for the energisation of pumpsets, partly because he was interested in installing 15 HP motor on his own well for which a scheme consisting of a few pumpsets had to be

1 Elected Head of the village body kmown as 'Gram Panchayat'.

formulated. Like-wise, in the village Walunj, 2 cultivators - one a village level retail shop owner who had his hotel-cum-shop at the foot of the temple referred to in Chapter III and also having an agricultural well and another transport-fleet-owner who was also having wells in the village - had initiated the efforts for energisation of pumpsets and their efforts to formulate a group of farmers willing to take electricity, bore fruits quickly since the M.S.E.B. officials, as stated earlier, had conditioned the electrification of the village-temple to the energisation of pumpsets, in the vicinity of it. In the village Dawadi, as stated earlier, a prominent villager (Estate Manager of erstwhile Princely State) had persuaded the villagers for the energisation of pumpsets and also to go in for a particular make of pumpset. As regards the village Narayangaon, many of the farmers (specially those using electric motor) of the village appeared to be well aware of the advantages stemming from the use of electricity since the village was on the State-Highway, and many of the farmers had connections with wholesalers dealing in vegetables, fruits etc., in Bombay and Poona. Here also, 2 villagers - one was a wholeseller having stalls in Bombay and the other, a local dealer in fertiliser - had taken initiative, since each one was having more than 2 wells begging energisation. As far as the remaining 2 villages, i.e., Narodi and Retawadi,

in the case of former, a local retail shop-owner had taken the lead since not only he was having his own well but also he was contemplating to formulate a lift-irrigation scheme, in the second stage, under which his sizeable chunk of land could be brought under irrigation. In respect of village Retawadi, only a total of 4 pumpsets were connected, all in the vicinity of 'Gaothan' area and having the power supply from the common transformer from which 'Gaothan' was having supply. It may be noted that out of the above-stated 4 pumpsets, one pumpset belonged to 'Grampanchayat', installed for the purpose of supply of water to the part of the village and to accommodate the pumpset within the scheme of electrification of village, the 'Sarpanch' of the village had persuaded 2 other farmers to go in for electricity on their near-by wells, at the same time taking electricity on his own well.

It can thus be seen from the above description that although the details of progress of each scheme concerning energisation of pumpset in each of the villages in the sample, were not available in the offices of the M.S.E.B. the same, though not in exact form, could be obtained from the 'local leaders' as they were closely associated with the scheme.

For the analysis of time-lag arising out of non-availment of power-supply on completion of scheme by some of the farmers due to motors being not installed, it was vital to

have exact information on the date of completion of scheme, for which the data were not available[1] as stated earlier. Hence the following assumption concerning the completion of a scheme of pumpsets has been made.

The scheme is assumed to have been completed when any one of the pumpsets falling in the scheme was connected. In other words, it is assumed that by the time all the poles were erected, lines were laid and finally the transformer was charged, at least one of the farmers had his pumpset installed on the well ready for connection so that as soon as the scheme was commissioned, it started operating. The rationale of the assumption being as under :

(i) Though not rigidly followed, the farmers were made aware of the rule stipulating the payment of minimum consumption charges on their part, from the date of completion of scheme, irrespective of their motors being ready for operation by that time or not;

(ii) As stated earlier, there were at least some farmers in every village, convinced of advantages of use of electri-

1 Technically speaking, the date of completion of a scheme is the one on which the transformer, wherefrom the distribution lines catering the consumers emanate, is commissioned. Although the maintenance of such details was important from the point of view of charging the minimum bill to the defaulting consumers not availing of the power-supply on completion of a scheme, in reality, the data was not assiduously maintained, possibly because the above-stated practice of charging the defaulting consumers was not put into effect.

city, and hence were keen to avail it of as soon as its supply commenced.

Table 8.13 presents village-wise information on (a) number of schemes under which pumpsets were connected (b) distribution of total pumpsets as well as sample number of pumpsets connected under each scheme by the time-lag, in terms of number of months/years, in their connection on completion of a scheme.

The table brings out the shift of emphasis in favour of agricultural use of electricity at the time of electrification of village, during the Third Five Year Plan period mentioned in Chapter II. As can be seen from columns (1) and (4) of the table, for the first three villages, namely, Chikhali, Phursungi and Dawadi, electrified during last year of Second Five Year Plan and the First Year of Third Five Year Plan, there is divergence between the respective dates of electrification of these villages and the dates of completion of first scheme under which the pumps were energised in these villages. While for the 4 villages, i.e., Narayangaon, Walunj, Retawadi and Narodi, electrified in the later years of the Third Five Year Plan, the commissioning of these energisation schemes of pumpsets had coincided with the electrification of the villages. In fact, the connection

Table 8.13 :Distribution of pumpsets connected in the sample villages by the time-lag in in their connection on completion of scheme.

Name of the village	Date of electri-fication	Total No.of Schemes for ene-rgisa-tion of pumpsets	Serial No.of Scheme	Date of completion of scheme for ener-gisation of pump-sets	Total No.of pumpsets connect-ed under the scheme	Distribution of pumpsets connected by time-lag in connection as under			
						Less than 6 months	6 months - Less than a year	1 year - Less than two years	Over 2 years
	1	2	3	4	5	6	7	8	9
Vadgaon	13-12-57	Nil	-	-	2(-)	1(-)	-	-	1(-)
Chikhali	27-6-60	3	I	2-2-63	10(5)	10(5)	-	-	-
			II	3-12-63	11(6)	11(6)	-	-	-
			III	26-10-64	18(6)	18(6)	-	-	-
Phursungi	11-12-61	2	I	1-4-62	22(7)	10(3)	2(1)	10(3)	-
			II	11-1-65	13(3)	11(3)	2(-)	-	-
Dawadi	30-6-62	1	I	1-2-65	29(15)	29(15)	-	-	-
Narayangaon	16-12-62	3	I	16-12-62	4(2)	4(2)	-	-	-
			II	24-11-63	23(9)	6(3)	17(6)	-	-
			III	29-10-64	26(5)	24(5)	-	2(-)	-
Walunj	21-10-63	1	I	21-10-63	18(7)	8(4)	4(-)	6(3)	-
Retawadi	26-1-64	Nil		26-1-64	5(3)	4(3)	-	1(-)	-
Narodi	31-8-64	1	I	31-8-64	14(7)	14(7)	-	-	-
				Total	195(75)	150(62)	25(7)	19(6)	1(-)

Note: Figures in brackets indicate sample number of electric motors.

to any single pumpset in those villages led to the villages being declared as electrified.

The above-stated phenomenon (the time-lag in the development of agricultural use of electricity as noticed in the villages electrified at relatively earlier dates, while no such time-lag for this use of electricity in the villages electrified at later date) could also occur because this particular use of electricity was becoming popular gradually with spread of electrification programme in the district - a point brought out by most of the local 'leaders' in their discussion.

Time duration for completion of Scheme : We shall now narrate, in brief, the observations of local leaders which have bearing on the time-duration taken for completing a scheme by the M.S.E.B. and other ancillary aspects.

Actually, the completion of a scheme involved its implementation in two stages, namely, its formulation and its construction. In fact, the role of the local 'leaders' should have been limited to the stage of formulation of a scheme only, i.e., preparing the fellow-cultivators to take up electricity by convincing them of the benefits of the use of electricity. Further, they had also to see that the required number of farmers (the number which satisfies the norm of 15 per cent revenue per annum over the cost of scheme)

filled in the application and paid the security deposit so that the construction work commenced. However, it may be observed that their assistance along with other cultivators, whose wells were part of the scheme, was sought by the M.S.E.B. officials even during the stage of construction, for transport of poles and its erection, under the plea that immediate transport was not available and the labour available with them was short. This was reported by almost all the local leaders except the one belonging to the village Dawadi and 14 of the farmers in the sample of electric motors from the villages Chikhali, Narodi and Walunj.

The above-stated exploitation[1] of villagers was possible because of over-enthusiasm displayed by the leaders and the urgency[2] shown by some of the farmers.

As regards the time-dimension involved in the formulation of scheme, it varied from village to village and within the village between schemes ranging between 15 days to over 6 months. The time-dimension involved in the formulation of a scheme, appeared to be determined by (a) number of wells

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1 It may be noted that no cartage was paid to those who used their carts for transport of poles nor labour charges were paid to the farmers who worked on erection of poles.

2 Such of the cultivators who disposed of their existing modes of irrigation, particularly engines for which the right bargain was difficult to strike, in anticipation of electricity, showed signs of exasperation when its advent was delayed and the crops were likely to be damaged for want of irrigation.

required to make the scheme viable and number of individually owned wells among such wells (b) the location of the village vis-a-vis town/city and (c) the influence wielded by the leader.

For example, in the villages Chikhali and Phursungi, located on the periphery of Poona city, the formulation of first schemes took hardly 15 days. It is to be noted that in the first scheme of Chikhali only 10 pumpsets were included of which 8 were individually owned (5 out of these 8 fully-owned sets are included in the sample). Although, the first of the 2 schemes implemented in the village Phursungi consisted of 22 pumpsets, as many as 16 out of these 22 pump-sets were individually owned (7 out of these 16 individually owned pumpsets are included in the sample). As regards the remaining 6 jointly-owned sets, 4 out of these 6 sets were partly owned by the 3 of these 16 farmers who owned the above-stated 16 individually owned pumpsets.[1]

It may be observed that the larger the proportion of individually owned wells in the group, the smaller was the number of people to be contacted and convinced than when the proportion of such wells was small, i.e., proportion of jointly-owned wells was large. Apart from this, even if the partners

1 This information was revealed in the course of survey wherein the data on total irrigational holdings of the farmers got selected under the sample of modes, was collected.

of jointly-owned wells were convinced of the benefits of electrification and decided in its favour, they took time in finalising the arrangement for financing of the pump-set (such as which of the partners had to bear the cost initially and the method of reimbursement to him, etc.) so that they could effect payment of security deposit.

Similarly, when the village was near a major city like Poona, the job of such 'leaders' was facilitated with many of the villagers already in the know of the benefits of electrification, particularly due to easy accessibility of the villages to the agents of competing firms dealing in pump-sets.

As in the case of the first schemes of these 2 villages, i.e., Chikhali and Phursungi, in respect of village Dawadi also, the scheme was formulated within a month's time. This was possible because the local 'leader', as pointed out earlier, could exploit his position vis-a-vis villagers, to his advantage. It is to be observed that the scheme could be formulated within such a short period in spite of the fact that as many as 18 out of 29 pumpsets were jointly-owned.

Excepting the first scheme of Narayangaon and the scheme implemented in Retawadi which were not special schemes but part of village electrification schemes,[1] in respect of other

1 No estimate of time-dimension involved in the formulation of village electrification scheme could be had from local leaders, particularly Narayangaon, which was a big village and was to be electrified since the main transmission line was to pass through it.

schemes mentioned in the table above, the time-dimension involved at the stage of formulation was around 6 months barring the scheme in the village Walunj for which it was stated as 3 months. The main reason for delay at the formulation stage for these schemes was the preponderence of jointly-owned wells in the schemes. Thus in the third scheme of village Chikhali, there were 9 jointly-owned wells out of 18, in the second and third scheme of village Narayangaon, there were 10 each of jointly-owned wells out of total of 23 and 26 wells, respectively. Like-wise, out of 14 wells included in the scheme of village Narodi, as many as 9 were jointly-owned. As far the village Walunj, though the scheme of 18 wells consisted of 6 jointly-owned wells, the relatively quicker formulation of the scheme was perhaps possible as they were given to understand, by the M.S.E.B. officials, that the electrification of an important temple in the vicinity depended upon the electrification of wells.

Lastly, two important aspects of formulation of scheme are discussed below. The one of the two aspects pertains to the method adopted by some of the farmers for getting their wells included in the scheme[1], while the other related to the role played by other agencies in the formulation of scheme.

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1 This method was observed in 2 villages from the sample.

According to the then existing rule for granting connection for a pumpset, 300 meters or 1000 feet of overhead line was provided free by the Board. For an excess of line, above 1000 feet required to reach the well, it was stipulated that the farmer (consumer) would reimburse to the Board the cost of such line at the rate of Rs.2/- per foot. Thus, if the distance from the nearest well (well of a willing farmer) included in the scheme was 1500 feet then the farmer would bear the cost of Rs.1000 for an extra 500 feet of line laid. To subvert this rule where it was applicable, some farmers had adopted ingenious method.

Each of 3 farmers (2 from the village Phursungi and 1 from the village Walunj) had paid the security deposits of Rs.156/- for a well lying in between his well and the nearest well originally included in the scheme, so that the effective distance from his nearest well now, was reduced to less than 1000 feet and he was saved of paying relatively higher amount. In 2 out of these 3 cases, the security deposit was paid without the knowledge of the farmer owning the well, resulting in his harrassment at the hands of officials of the Board, when he did not avail of electricity despite the fact that pole was provided at his well. Subsequently, these 2 farmers (whose deposits were paid by others) did take up electricity and their pumpsets appear in the above table under the column (8),

depicting time-lag of 1 year to 2 years in connection of pump-set, on completion of scheme. The above method is described here to point out the ways in which sometimes, the Board lost its revenue because of the schemes being not thoroughly scrutinized before implementation.

As regards the other aspect, viz., the role played by other agencies in the formulation of scheme, the cultivators as well as the local leaders were asked whether they received any assistance, particularly of 'Gramsevak' (a village-level official of the Block Development Office), in the formulation of scheme. In no case the answer was affirmative. In fact, some of the local leaders had expressed that any assistance from Gramsevak would have certainly quickened the process of formulation. Two of these local leaders stated that their assistance in helping the partners of jointly-owned wells in arriving at arrangement for sharing the cost of pumpset would have yielded quick results as compared to their own efforts, since these gramsevaks were third-party-men, while leaders being local people and their relations with all the partners being different, some of the partners had suspicion about the method suggested by the leaders to share the cost.

Apart from this, the gramsevak having some knowledge about the agricultural operations, irrigation etc., his services would have been also helpful in dispelling the

misconception in the minds of oil engine users as regards the viability of use of motor, thus, furthering the spread of electrification. Unfortunately, the reasons for indifference, on part of gramsevak, to this important programme, could not be ascertained from them.

The time-dimension involved in respect of construction of scheme also varied from one scheme to another as in the preceding stage, i.e., the stage of formulation of scheme; the range of time-dimension involved being 3 months to over 2 years (nearly 2 and quarter years). Thus, the first scheme in the village Phursungi was completed in the shortest period of 3 months while the completion of first scheme in village Chikhali took about 2 years and the construction of scheme in the village Dawadi was over in a period of 2 and a quarter years, after its formulation.

As regards the other special schemes for energisation of pumpsets mentioned in the above table, the time-dimension involved in their construction ranged between 6 months to 1 year. While 4 schemes mentioned in the above table (II and III scheme of village Narayangaon and II scheme of village Phursungi and III scheme of village Chikhali) were completed in a period around 6 months, the construction of the remaining 3 schemes took 9 to 12 months.

The time-dimension involved in the construction of a scheme does not connote span of time from the commencement of construction till its completion but only indicates the time lapsed after the formulation of scheme till any of the pumpsets of the scheme is connected. As such, the variations in the time-dimension involved in the construction of schemes given in the above table are not accounted by such factors as different sizes of schemes (number of pumpsets in the scheme), the location of wells in the scheme making it difficult the erection of poles etc., but by such factors as the delay in deciding whether the erection work would be done by the Board departmentally or would be assigned to the labour contractor, and in the case of latter, in completion of formalities thereof, shortage of equipment and lack of transport facilities, particularly when the work was undertaken by the Board. In some cases, the construction of a viable scheme was deliberately delayed by the officials of the Board, so as to get a few more pumpsets from the influential local leaders to make one more scheme and thus enabling them (officials) to fulfil the targets. The local leader of the village Chikhali stated that the construction of the first scheme was delayed because the Assistant Executive Engineer of the Board stated that it would only commence when at least another 10 people came forward for taking up electricity (or total of 20 people took pumpsets in the village). Thus the

construction of first scheme commenced only after the second scheme was finalised. Also, the construction was deliberately delayed in one case (in respect of village Dawadi) on the plea that equipment was not available, because the local leader antagonised the Assistant Executive Engineer on the details of scheme (number of pumpsets to be included and size of each pumpset in terms of Horse Power of motor), pressurising him through influencing his higher officials. The construction of the scheme was delayed so much so that ultimately, the local leader had to approach the then Finance Minister of the State who belonged to Poona District to see that the farmers were not put to inconvenience[1] because of the delay on the part of the Board Officials, in the construction of the scheme.

Lastly, from the data on the implementation of scheme, it appears that the schemes were expeditiously constructed when the erection was given to private labour contractors than when it was departmentally done by the Board. For example, all the four schemes, which were completed within 6 months, were handled by the labour contractors, while only one of the

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1 Most of the farmers whose wells formed the part of the scheme, had availed of loan from the Land Development Bank for the installation of pumpsets. Because of the influence of the local leader with the Bank, the loans were sanctioned expeditiously and the pumpsets were installed quickly. With the delay in the construction of scheme, the farmers had not availed of the benefits of motor even after one year of their installation when the first repayment instalment was due to be paid to the Bank. They had, therefore, to approach the Finance Minister to use his office with the Land Development Bank so that it sanctioned moratorium in the repayment of the loan, on account of special circumstances.

schemes constructed by the Board was over within 3 months; the remaining schemes were completed in one year.

Time Lag in Connection of Pumpsets after Completion of Scheme

To start with, in table 8.14, we present distribution of a sample number of pumpsets on time-lag in their connection and their ownership pattern i.e. individually owned or jointly-owned.

Table 8.14 : Distribution of sample number of pumpsets on time-lag in connection and the type of ownership.

Ownership of Pumpset	Time-lag in connection of pumpset on completion of scheme			
	Upto 6 months	Above 6 months to less than a year	One year and above	Total
Individually owned	34	6	6	46
Jointly-owned	28	1	-	29
Total	62	7	6	75

It can be observed from the table that out of a sample-size of 75 motors, 46 were individually owned while 29 were jointly-owned. Further, it is interesting to note that whereas only 1 out of 29 jointly-owned pumpsets showed time-lag in connection beyond 6 months, as many as 12 out of 46 individually owned pumpsets (26.1 per cent) showed time-lag in connection beyond 6 months. Thus, on completion of a scheme, individually-

owned pumpsets showed relatively delayed connections as compared to jointly-owned pumpsets.

Taking electricity to the well involved performing of complex jobs such as transportation of poles, arranging for finance for the purchase of motor and pumpset, making arrangement for its installation, and in some cases, making an effort to find a customer for the existing mode of irrigation, particularly oil engine, and obtaining certificate from electrical inspector to the effect that the installation is fit for connection. In such cases where the finance had to be borrowed from the Land Development Bank, the applicant had to visit the office of the Bank, usually located at taluka headquarters, at least 4 to 5 times. The joint-ownership of pumpset facilitated the division of labour which, in turn, enabled the joint-owners to perform these jobs expeditiously as compared to an individual farmer and hence the relatively delayed connections in respect of individually owned pumpset.

Thus, it can be seen from the above that having decided to take up electricity, the partners of the jointly-owned wells, did not delay in using power, once the scheme was completed, although at the stage of formulation of a scheme, they generally hesited and delayed the decision, as stated earlier.

Previous Mode of Irrigation and time-lag in connection :
In Table 8.15, we present the distribution of pumpsets on two parameters, viz., time-lag in connection and the type of mode of irrigation on the well previous to employment of electrically operated pumpset. It may be noted that the above-stated distribution is presented both for individually-owned pumpset and jointly-owned pumpsets separately.

From the last 4 columns of the table, it can be seen that out of 13 pumpsets showing time-lag in connection of the extent of more than 6 months, only 3 pumpsets (or 23.1 per-cent) were preceded by bullock-lift as the mode of irrigation, while as many as 10 pumpsets (or nearly 77 per cent of the total) were preceded by oil-engines. It can also be observed from these columns of the table that whereas out of 46 pump-sets having bullock-lift as previous mode, only 3 (i.e., 6.5 per cent) had shown time-lag of more than 6 months in connec-tion, as many as 10 out of 26 pumpsets (i.e., about 38.5 per-cent) having oil engine as previous mode, had shown delay in connection of the order of more than 6 months. It is to be noted that 6 out of these 10 pumpsets with oil engines as previous mode of irrigation, had shown time-lag of 1 year and above.

Thus, the table indicates that the shift from oil-engine to electric motor was more time-consuming as compared to shift from bullock-lift to electric motor.

Table 8.15 : Distribution of sample number of pumpsets on time-lag in connection and the type of mode previously operated to the operation of electric motor.

Type of mode previously operated	Time-lag in connection of motor singly-owned				Time-lag in connection for motor jointly-owned.				Total for all motors			
	Upto 6 months	Above 6 months to less than a years	1 year and above	Total	Upto 6 months	Above 6 months to less than a year	1 year and above	Total	Upto 6 months	Above 6 months to less than a year	1 year and above	Total
	1	2	3	4	5	6	7	8	9	10	11	12
Bullock Lift	17	2	-	19	26	1	-	27	43	3	-	46
Oil engine	14	4	6	24	2	-	-	2	16	4	6	26
New well	3	-	-	3	-	-	-	-	3	-	-	3
Total	34	6	6	46	28	1	-	29	62	7	6	75

6 As we have seen in Chapter IV, the purchase and installation of electric pumpset involved an expenditure ranging from Rs.2000 to Rs.3000. The time consumed in raising finance for installation of electric pumpset could also cause delay. In this context, in table 8.16, we have presented data on the time-lag in connection and the source of finance for the pumpset. It may be mentioned here that for the sake of simplicity, we have classified the source of finance into 2 types, viz., owned funds and borrowed funds, for the purpose of presentation. Further, it may be observed that while owned funds exclude the presence of other source, i.e., borrowed funds, the latter category does not always exclude the presence of the former, i.e., owned source, particularly because the 'borrowed funds' mostly refer to finance borrowed from institutional sources such as Land Development Bank, Block Development Office etc. and the extent of finance did not cover the entire expenditure for installation thus needing the supplement of some owned funds. All the same, it should be noted that whenever the 'borrowed funds' have been mentioned as source of finance in table 8.16, it denotes that such funds have covered at least 60 per cent of the total expenditure. As in the case of previous table, the data on time-lag in connection and sources of finance, have been presented for both the types of ownership pattern of pumpsets.

Table 8.16 : Distribution of sample number of pumpsets on time-lag in connection and the source of finance for motors.

Major source of Finance	Time-lag in connection for motors singly-owned				Time-lag in connection for motors jointly-owned				Total for all motors			
	Upto 6 months	Above 6 months to less than a year	One year and above	Total	Upto 6 months	Above 6 months to less than a year	One year and above	Total	Upto 6 months	Above 6 months to less than a year	One year and above	Total
	1	2	3	4	1	2	3	4	1	2	3	4
Owned Funds	14	2	2	18	16	-	-	16	30	2	2	34
Borrowed Funds	20	4	4	28	12	1	-	13	32	5	4	41
Total	34	6	6	46	28	1	-	29	62	7	6	75

It can be seen from columns 10 and 11 of the table that out of 13 pumpsets showing 'delay' (time lag of over 6 months) in connection, 4 were having owned funds as source of finance, while 9 had borrowed funds from institutional sources for financing the pumpset. It may be noted that out of these 9 pumpsets having borrowed funds as sources of finance, 6 pumpsets were those having oil engine as previous mode. Furthermore, it is interesting to mention here that all these 6 engines were finance through the loans and at the time of application for fresh loan for pumpset, all the repayment instalments of the loan availed for engine were not cleared up by their respective owners. These cultivators were, therefore, trapped in a vicious circle. Because they had not cleared of the loan availed for the purchase of engines, they did not have full ownership-rights to dispose them of so that they could raise funds to install electric pumpsets. On the other hand, their applications for the fresh loan for the purchase of electric motor were not being sanctioned since they were already under debt and therefore could not offer enough collateral. The owner-cultivators had, therefore, to wait till their entire loan for the engine was paid off, and they could avail of fresh loan, which partly explains the delay in their connections. Thus, the source of finance also determined time lag in connection.

As regards the other 4 electric pumpsets with oil engine

as their previous mode of irrigation but financed out of owned funds, the delay in their connection was due to peculiar problem faced by their owner-cultivators. All these owner-cultivators had full ownership rights in their engines to dispose them of. Further, it may be noted that those engines were in good working condition according to their owner-cultivators and as such could bring them sizeable amount, if disposed of. The owner-cultivators of these engines were, therefore, desirous of disposing them of and raise partly the finance required for the installation of electric pumpset. Since the engines were already in use, their owner-cultivators wanted a customer who would not only offer the price according to their estimated value of the engine but would also pay the price in advance and take away the engine only after electric pumpset was installed. In other words, they were in search of a customer for the engine who would pay the selling-price of the engine in advance of its delivery so that they could use the money for the installation of pumpset, and at the same time, would use the engine till the electric pump-set was finally installed. All other things being ready (i.e., pole from which the pumpset to be connected, is erected by the Board), installation would take about 30 to 45 days and hence they were finding it difficult to get a customer who would lend about Rs.1500 to Rs.2000, depending upon the value

of the engine, free of interest rate for such a period.

The delay in connection of these 4 pumpsets was explained by their owner-cultivators in terms of difficulty in finding out a 'willing' customer for their engine, agreeing to the above-stated conditions.

One more common characteristic of the irrigational holding of the pumpset-owners with oil-engine as previous mode of irrigation and showing 'delay' in connection, is worth mentioning here. To gauge the effect of this characteristic, though in an indirect manner, on 'delay' in connection, it would be necessary to contrast the observed common characteristic of these pumpset-owners with the pattern of irrigational holdings of those pumpset-owners who have not reported 'delay' in connection.

It can be seen from the Table 8.15 above that 16 pumpsets with oil engine as previous mode of irrigation, had shown time-lag of only less than 6 months in connection while 10 with the same type of previous mode, had shown 'delay' in connection. Further, it may be noted that while 16 pumpsets of the former category belonged to 16 cultivators, 10 pumpsets of the latter category were owned by 9 cultivators (different from above-mentioned 16) with 2 pumpsets being owned by 1 cultivator who had 2 engines previously employed on 2 wells

wherein pumpsets were now being operated. Thus, in respect of this particular cultivator there was no alternate venue (owned well) available for employing the engine once displaced after installation of electric motor.

Table 8.17 depicts pattern of irrigational holdings of two sets of cultivators - one reporting 'delay' in connection and the other being connected within period of six months. Since the objective of presenting the distribution of irrigational holding is to find out the availability of alternate venue for employment for engine after its displacement, the above-mentioned cultivator (having 2 engines on 2 of his wells) has been shown twice despite owning 2 wells.

Table 8.17 : Comparative distribution of irrigated holding of cultivators reporting 'delay' and not reporting 'delay' in switching over to electricity.

Distribution of irrigated holding of cultivators							
Reporting delay				Not reporting delay			
No.of cultivators having ownership rights in wells as under				No.of cultivators having ownership rights in wells as under			
1 well	2 wells	3 wells & above	Total	1 well	2 wells	3 wells & above	Total
7	2	1	10	3	8	5	16

It can be seen from the above table that the pattern of irrigational holdings of the cultivators showing time-lag of less than six months was more conducive to shifting the oil-

engine after its displacement, in comparison to that of the cultivators reporting 'delay', due to not possessing alternate venues for the employment of displaced engines. Thus, while 13 out of 16 cultivators not reporting delay had alternate venues available for deployment of their displaced engines, as many as 7 out of 10 cultivators reporting 'delay' had no such venue, owning only one well. It may be mentioned here that 3 out of 16 cultivators not reporting delay had retained their engines on other wells even at the time of survey.

The keenness shown by these cultivators in disposing of the engine before the installation of electric pumpset, was mainly due to the following two important factors :

(a) As described earlier, the pattern of irrigational holding of these cultivators did not provide any alternative use for the engine, once the pumpset was installed;

(b) Apart from the fear of the cultivators that the demand for the engine would diminish with the spread of electrification, the redundence of the engine with the installation of the pumpset would further weaken his bargaining power for the price of engine.

Thus, it can be seen from the above discussion that for an oil-engine user willing to switch over to electricity, the pattern of his irrigational holding played important role in

determining the time-lag in the connection of the electric pumpset.

Similarly, the above discussion reasserts the statement made earlier, viz., although the criterion of number of engines existing in a village is self-sufficient in judging the potentiality of irrigational use of electricity in the village, it is not self-evident whether the estimate of the revenue return from the village in the immediate future of its electrification can be based on the number of existing engines, particularly when the shift from engine to electric pumpset was observed to be a time-consuming process.