

**Report of the Committee To  
Estimate the Demand for Pumpsets During 1978-83  
and  
Study the Policy and Procedure of Financing It**

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**Bombay**

**1979**

Report of the Committee To  
Estimate the Demand for Pumpsets During 1978-83  
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**Agricultural Refinance and Development Corporation**

**Bombay**

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## CONTENTS

	Page
Chapter I	Introduction .. .. . 1
Chapter II	(A) Expected Demand for Irrigation Pumpsets .. .. 6
	(B) Demand for Electric Pumpsets .. .. . 8
Chapter III	Demand for Diesel Pumpsets .. .. . 28
Chapter IV	Demand for Replacement of Old Pumpsets and Total Demand .. .. . 35
Chapter V	Repair and Maintenance Facilities .. .. . 40
Chapter VI	Policy and Procedure for Loans and Repayments .. 43
Chapter VII	Summary and Recommendations .. .. . 56
Appendices	.. .. . 62

## CHAPTER I

### INTRODUCTION

1.1 The Board of Directors of the Agricultural Refinance and Development Corporation at its meeting of 12 May 1978 decided to constitute a committee to estimate the demand for pumpsets for irrigation during the current Plan and to examine the policies and procedures followed by the financing institutions in making loans for the purpose.

1.2 The Terms of Reference of the Committee were as under :

(i) To estimate the agricultural pumpset population in the country as of 30 June 1978 by source of motive power and project the likely annual increase during each of the 5 years from 1978 to 1983 against the background of

- (a) the priority given by the Government to rapid extension of irrigation facilities and the potential proposed for the next 5 years for minor irrigation and
- (b) the substantial addition that is being contemplated for power generation capacity and transmission and distribution system under the power development programme.

(ii) In relation to the projection under item (i), to estimate separately the annual demand for (a) new pumpsets and (b) equipments for replacement purposes over the five years, 1978-1983, by source of motive power.

(iii) To estimate the extent to which the replacement demand is caused by obsolescence and substitution (of electric pumpsets for diesel pumps), respectively.

(iv) To inquire into the servicing and repair facilities available and connected technical aspects.

(v) To examine the present loan policy and procedure and the repayment system adopted by financing institutions and suggest rationalisation thereof, if needed, based on the economic life of pumps as well as the additional income generated by such investments for small, medium and large farmers.

(vi) To organise and conduct such field studies as may be necessary to collect the requisite data, and

(vii) To make recommendations of other related aspects which, in the opinion of the Committee, are relevant and important.

1.3 The Committee was meant to be broad based, by the inclusion of representatives of the Government of India, the Reserve Bank of India, the State Bank of India, the Rural Electrification Corporation, the Commercial Banks, the Land Development Banks, the Pump Manufacturers and the Agricultural Refinance and Development Corporation (ARDC). Letters were sent out in July 1978 to the different organisations request-

ing them to propose their nominees on the Committee. After these were received, the Committee, formally constituted, held its first meeting on 18 October 1978. The following were the members of the Committee :

1. Dr. Nilakantha Rath, Chairman  
Joint Director,  
Gokhale Institute of Politics and Economics,  
Pune 411 004.
2. Shri R. S. Saksena, Member  
Superintending Engineer,  
Government of India,  
Department of Agriculture and Irrigation (M.I. Section),  
Krishi Bhawan,  
New Delhi 110 001.
3. Shri S. V. R. Rao, Member  
Management Specialist,  
Rural Electrification Corporation Ltd.,  
DDA Building, Nehru Place,  
New Delhi 110 019.
4. Shri R. R. Nair, Member  
Zonal Manager, Jyoti Limited,  
Sterling Centre, 16/2 Dr. A. B. Road,  
Worli, Bombay 400 018.  
(Representative of the Indian Pump  
Manufacturers' Association)
5. Shri A. Narasimha Reddy, Member  
Managing Director, Andhra Pradesh  
Cooperative Central Agricultural Development Bank Ltd.,  
Sahakara Bhavan, Barakatpura,  
Hyderabad 500 027.  
(Representative of National Cooperative Land Development  
Banks Federation)
6. Shri K. C. Berry Member  
Assistant General Manager,  
Priority Sector and Lead Bank Division,  
Punjab National Bank, 5, Parliament St.,  
New Delhi 110 001.  
(Representative of the Indian Banks' Association)
7. Shri V. R. Joshi, Member  
Deputy Chief Officer,  
Agricultural Banking Department,  
State Bank of India, Central Office,  
Post Box 12, Bombay 400 021.  
(Representative of State Bank of India)

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|---|------------------|
| 8. Shri V. S. Dabholkar,<br>Deputy Chief Officer, Agricultural Credit Department,<br>Reserve Bank of India, Garment House, Worli,<br>Bombay 400 018.<br>(Representative of the Reserve Bank of India) | Member           |
| 9. Shri Y. S. Borgaonkar,<br>Deputy Managing Director,<br>Agricultural Refinance and Development Corporation,<br>Sriniketan, Worli, Bombay 400 018.<br>(Representative of the ARDC)                   | Member           |
| 10. Shri S. V. Bopardikar,<br>(Representative of the Director<br>General of Technical Development,<br>Govt. of India, New Delhi)  | Member           |
| 11. Shri P. Raman,<br>Director,<br>Programming Section,<br>Agricultural Refinance and Development Corporation,<br>Sriniketan, Dr. A. B. Road,<br>Worli, Bombay 400 018.                               | Member-Secretary |

### **Method of Work**

1.4 The Committee held in all 5 meetings between October 1978 and August 1979 (Appendix A). The first meeting was attended by S/Shri Saksena, Nair, Reddy, Joshi and Borgaonkar, besides the Chairman and Member Secretary. At this meeting, on a request from the Chairman, the Managing Director of the Corporation, Shri M. A. Chidambaram, gave a brief account of the circumstances leading to the appointment of the Committee. He indicated that the Committee while estimating the future demand for pumpsets may also examine the increasing need for replacement as in the context of a general unsatisfactory saving capacity of farmers, the resources for such replacements have to come from financial institutions. He also desired that the Committee may consider the maturity period of loans and indicate whether any change is called for in the life of pumpset which at present has been notionally reckoned as 7 years. While fixing the maturity period of loan, he, however, felt that it should be kept in mind that in agricultural investment there is a possibility of deferment of payment due to natural calamities, and hence in any code of prescription there should be a margin for cushion. He foresaw, in this context, the need for a limited field study for the purpose but felt that such a study should be within manageable proportion so as not to delay the report unduly.

1.5 The Committee considered in the meeting the terms of reference against the background of the observations of the Managing Director, and chalked out the broad plan of approach for its work. This included (i) initiating a programme for collection of published material relevant to the work through the members themselves who represented the different interests and also through the Regional Offices of the Corporation and (ii) conduct of a field study with the following main objectives :

- (a) to estimate the hours of use of a pump and the number of years for which it is used ;
- (b) to study the availability of motive power, diesel and electric, and allied effects ;
- (c) to identify the deficiencies, if any, in the procedures and methods followed by the financing institutions and the extent of financing the investments by farmers themselves ;
- (d) to collect information on the existing repair/service facilities and the technical guidance available to the farmers.

1.6 Since both the items of work were time-consuming, it was agreed in the first meeting that the next meeting could be held only after some progress was achieved in this direction. The second meeting was thus held on 21 March 1979. Between the first and the second meetings, the Secretariat of the Committee collected all available material, through the Regional offices of the ARDC on State-wise, year-wise data of pumpset population, area irrigated in the various States, the source of irrigation, etc. Letters were addressed to pumpset manufacturers through their Association for information; also a request was made to the Federation of Land Development Banks to supply year-wise data on number of pumpsets financed and the amounts sanctioned in different States. All State Electricity Boards were also requested to supply year-wise data since 1966-67 on the number of pumpsets energised in villages electrified in their States. The response to our request for supply of the material from the various sources, except the Regional Offices of the Corporation, was not adequate and satisfactory. The organisations which provided information to the Committee are listed in Appendix B. In the meeting held on 21st March 1979 where besides the Chairman and the Member-Secretary, only the representatives of the Reserve Bank and the ARDC were present, it was, therefore, agreed that the Committee should utilise whatever information was collected by the secretariat and go ahead with the work rather than endlessly wait for further material.

1.7 The third meeting was held on 6 June 1979 which was attended by Shri Rao from REC and Shri Berry representing the Indian Banks' Association for the first time. Shri Reddy and the members from the Reserve Bank and ARDC were also present in the meeting. At this meeting, the background notes circulated earlier, which were designed to form the basis of the draft report, were discussed. The general approach was approved subject to certain modifications suggested by the members. A further meeting was held on 23 June when, besides those present during the previous meeting, Shri Saksena, Shri Joshi and Shri Bopardikar (for the first time) were also present. Members who had not commented on the notes in the earlier meeting, made their comments and suggestions.

The last meeting was held on 6 August 1979 when the draft report was considered and approved by the Committee.

### **Structure of the Report**

1.8 The report is presented in seven chapters. Chapters II, III and IV deal with the estimation of demand for electric pumpsets, for diesel pumpsets, and replacement



demand for pumpsets, respectively, for the 5-year period, 1978-83. In Chapter V, repair and service facilities available to the farmers at the village level have been briefly examined. Chapter VI summarises the basic policies and procedures suggested by the RBI and followed by the financing institutions in financing pumpsets and makes certain recommendations. Chapter VII contains the summary of findings and recommendations.

### **Acknowledgement**

1.9 The Committee extends its most sincere thanks to all the organisations, listed in Appendix B, which readily responded to its request for information. The information provided by them has been very useful.

The Committee is particularly grateful to Shri D.V. Brahme, Sales Executive, Kirloskar Oil Engines Ltd., Pune, for unhesitatingly placing his wide knowledge of the market for diesel engines in India at the disposal of the Committee and for making very useful suggestions.

The Committee wishes to express its thankfulness to Shri V.V.S. Mani, Deputy Director (Technical), ARDC, who attended the meetings as a special invitee and gave considerable help, advice and information particularly on all technical aspects.

We wish to place on record our sincere appreciation of the work of our colleague and Secretary Shri P. Raman, who, apart from other things, shouldered the responsibility of organising the special survey required by the Committee, and took pains for the timely collection of data from the different official and non-official agencies.

The main burden of the secretarial work fell on Dr. V.N. Saksena, Deputy Director, ARDC, who was engaged full-time in the work of the Committee, including supervision of field investigations. We wish to place on record our appreciation of his contribution in all aspects of the Committee's work.

Shri P. Vivekanandan, Development Officer, ARDC, was of invaluable help in processing the data collected during the survey and preparing the notes thereon, as well as in the preparation of the final Report. The Committee greatly appreciates his careful and devoted work.

Shri R. Narasimhulu, Assistant Development Officer, not only supervised part of the field investigations, but helped the Committee in scrutinising the data, tabulations and proofs. Kum. J. Indumati, Agricultural Economist, helped in data processing and statistical work. We thank them for their help.

A number of other staff members of the ARDC were also associated with the work of the Committee either in the office or as investigators and supervisors in the field investigation. They are named in Appendix C. The Committee thanks them all for their sincere help in the discharge of its responsibility.

## CHAPTER II

### (A) EXPECTED DEMAND FOR IRRIGATION PUMPSETS

2.1 Expansion of irrigation has been the single most important factor in the strategy for development of agriculture in India since the beginning of the planning process. The stress has been not only on the development of major and medium irrigation projects, but also, since the Third Five Year Plan, on the expansion of minor, particularly the lift irrigation\* sources. Consequently, lift irrigation has come to acquire a significant place in the total area under irrigation in the country as will be seen from the table below.

#### DEVELOPMENT OF IRRIGATION DURING THE FIVE YEAR PLAN PERIODS

Source of Irrigation	(Area in Million Hectares)							
	Area irrigated in 1950-51	Total potential created by the end of			Additional potential proposed to be created during 1978-83	Targeted total potential by end of 1982-83	Ultimate irrigation potential feasible	
		1968-69	1973-74	1977-78				
1	2	3	4	5	6	7	8	
1. Surface Water ..	16.1	24.6	27.7	32.5	10.0	42.5	72.0	
(a) Major & Medium	9.7 (43)	18.1 (49)	20.7 (47)	25.0 (48)	8.0	33.0 (47)	57.0 (51)	
(b) Minor	6.4 (28)	6.5 (17)	7.0 (16)	7.5 (14)	2.0	9.5 (14)	15.0 (13)	
2. Groundwater ..	6.5 (29)	12.5 (34)	16.5 (37)	19.8 (38)	7.0	26.8 (39)	40.0 (36)	
3. Total	22.6 (100)	37.1 (100)	44.2 (100)	52.3 (100)	17.0	69.3 (100)	112.0 (100)	

Figures in brackets are percentages to the total.

Source : Government of India, Ministry of Agriculture & Irrigation.

2.2 The present estimated ultimate potential of irrigation from all sources, expressed in terms of area that can be irrigated, is 112 million hectares of which 40 m.ha. or about 36 per cent would be with groundwater, which forms the bulk of all sources of lift irrigation in the country. At the beginning of the First Plan, groundwater accounted for less than 30 per cent of the total irrigated area. The importance of groundwater increased from the Third Plan onwards. By the end of 1977-78, area irrigated by groundwater formed about 38 per cent of the total irrigated area. The current Plan envisages an increase in the irrigation potential by 17 million hectares out of which 7 million ha. or about 41 per cent will be from groundwater. This shows that irrigation through exploitation of groundwater has become more and more important in successive Plan periods.

\*The expression "lift irrigation" has often been used to connote irrigation by lifting water from streams with pumpsets. Lifting water from dugwells and tubewells has not been called "lift irrigation". In this report, however, we use the expression "lift irrigation" to mean lifting water for irrigation from dugwells, tubewells and streams, with the help of diesel or electric pumpsets.

2.3 The sources of lift irrigation are dugwells, deep and shallow tubewells, and small rivers and streams. During the last two decades in particular, most of the traditional bullock-drawn or manually operated water lifts have been replaced by diesel or electric engine operated pumpsets. Almost all new dugwells are being fitted with such pumps, and the tubewells are of course all operated by electric or diesel engines. The demand for the installation of diesel engines or electrically operated pumps for purposes of irrigation in the course of the current Plan period, 1978-83, will depend, among other things, on the number of dugwells that remain to be fitted with pumps and the number of new dugwells and tubewells that may be sunk during the period, which in turn, depend on the availability of adequate groundwater, on the one hand, and cheap and easy availability of diesel oil or dependable supply of electricity, on the other.

2.4 At the prevailing prices of irrigation water and irrigated farm products there is a very considerable demand for pumpsets in the country, much larger than what it may ultimately be possible to install during the current Plan period. The inadequate and/or uncertain availability of groundwater in some areas, the inadequate development of infrastructure facilities like roads, diesel oil shops and electricity in other areas, and, finally, the obstacles arising out of fragmented holdings, restricted rights in land, inadequate knowledge on the part of farmers, besides financial difficulties, have, in the past, been responsible for the lag in the development of sources of lift irrigation. What we are attempting is an estimation of what is feasible or most likely in the nature of actual installation of pumpsets during the current Plan period, 1978-83.

2.5 Projections of the total number of pumpsets likely to be needed have been attempted preparatory to the draft of the current Plan, 1978-83. The Working Group on minor irrigation, set up by the Planning Commission, gave its report in November 1977\*, which contains the Group's estimate of the number of additional pumpsets, electric and diesel, likely to be installed during 1978-83. We have also the estimates prepared by the Central Electricity Authority as well as by a number of State Electricity Boards about the additional number of electrically operated irrigation pumpsets likely to be installed during 1978-83. Some time has elapsed since these estimates were made, and in the meanwhile we have had the experience of the first year of the current Plan. We propose to use all this information to attempt an estimation of the number of additional pumpsets likely to be installed during 1978-83.

2.6 The total demand for additional pumpsets during 1978-83 consists of two parts : demand for new diesel or electrically operated pumpsets, and demand for new pumpsets to replace old and worn out pumpsets. We propose to discuss the first type of demand in this and the next Chapter, and the demand for replacement of old pumpsets in Chapter IV.

2.7 Irrigation pumps are operated by either diesel engines or electric motors. The electric pumpsets are less expensive than the diesel pumpsets, and the cost of electricity is less compared to that of diesel oil. Further, in the recent past there have been frequent upward revisions in the diesel prices and this trend is likely to continue. Therefore, if all the villages are electrified and the finance to buy electric motors to replace

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\*Interim Report of the Working Group on Minor Irrigation for formulation of the Plan Proposals for the Years 1978-83, Government of India, Ministry of Agriculture and Irrigation (Dept. of Agriculture), Minor Irrigation Division, New Delhi, November 1977.

the diesel engines is readily available, there will be large scale shift to electrically operated pumps. Moreover, in villages already provided with electricity, the new pumpsets would of course be electrically operated. With expanding rural electrification these processes have been going apace during the last two decades. However, in many states of India, complete rural electrification is unlikely by 1983. Expansion of lift irrigation facilities in non-electrified villages can take place only with the help of diesel engine operated pumps. It is, therefore, necessary to estimate the likely demand for new diesel and electric pumps separately. We take up the likely demand for electric pumpsets first, in this Chapter.

## (B) DEMAND FOR ELECTRIC PUMPSETS

2.8 The total demand for electrically operated pumpsets consists of two parts : (i) the replacement of existing diesel pumpsets by electrically operated pumpsets when electricity becomes available and (ii) the installation of electrically operated pumps on new dugwells, tubewells and new water-lifting points on streams, as well as on existing wells without any such water-lifting device. In order to estimate the number of existing diesel pumpsets which would be replaced by electric pumpsets, it is necessary to know not only the number of diesel pumps in operation in the villages to be newly provided with electricity during the five years, 1978-83, but also the number of diesel operated pumps that remained to be substituted by electrically operated pumps in the villages that had already been electrified by 1977-78. However, it is not possible to do so, since no such information is available. We shall, therefore, attempt to estimate the total demand for electric pumpsets—for both replacement of diesel engine operated pumps and installation of new pumps—by other methods.

2.9 In each State, the State Electricity Board collects and provides information about the total number of electrically operated irrigation pumps installed in each year. Tables 2.1 and 2.2, respectively give the total number of electrically operated pumps at the end of March 1978 and the additional units of pumps during the year April-March for different years, upto 1979. Table 2.3 gives the linear and compound growth rates of electrically operated irrigation pumpsets during the period 1974-78 in each of the States in India.\*

2.10 If one assumes the same linear or compound growth rate to hold during the years 1978-83 as during the previous 5 years, then one can estimate the total number of electric pumpsets by end of March 1983, for every State separately. These estimated figures are given in columns 5 and 6 of Table 2.3 projected on the basis of linear and compound growth rates given in columns 3 and 4, respectively. The total number of electrical pumpsets in the country comes to 43.7 lakh units by the projection of the linear growth rate, and to 50 lakh units by the projection of the compound growth rate. The additional pumpsets expected to come into existence by March 1983 over and above the number reportedly existing at the end of March 1978, comes to 10.7 lakh units by the method of projection of the linear growth rates, and 17 lakh units by the projection of the compound growth rates.

2.11 A third method of projecting the number of electric pumpsets may also be tried. The introduction of new electric pumps depends largely on the number of villages likely

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\*The growth rates are arrived at by fitting trend lines to the cumulative data for each of the five years ending March 1974 to March 1978.

to be electrified, and partly on the number of pumpsets remaining to be energised in villages already electrified. The total number of villages electrified increased from 157,107 at the end of March 1974 to 216,898 at the end of March 1978 (Table 2.4) giving an annual linear growth rate of 15,307 villages a year. Col. 4 in Table 2.6 gives the linear growth rates of the villages electrified in different States during the years 1974-78. If we assume the new villages to be electrified during 1978-83 at the same rate as during 1974-78, then the number of villages likely to be provided with electricity by March 1983 in every State will be as shown in Col. 5 of Table 2.6. Of course, there are four States, Punjab, Haryana, Kerala and Tamil Nadu, where all the villages were either completely electrified by 1978 or were almost so and were expected to be completely electrified by 1983. In their case, no projection is called for. Similarly, for States like Jammu & Kashmir, Tripura and the Hill States of North Eastern India no projections of number of villages likely to be electrified has been attempted, partly because the information on this point for the years 1974-78 does not enable meaningful projection, and partly because in these States rural electrification may be only marginally related to energisation of lifts for irrigation. In any case, these are small States from the point of view of lift irrigation potentiality and exclusion of these from our calculation will not make significant difference to the total estimate.

2.12 Given the estimated number of villages likely to be provided with electricity by March 1983, the total number of electrical pumpsets can be estimated on the basis of the average number of electrical pumpsets per electrified village. The average number of energised pumpsets per electrified village will be affected, among other things, by the time-profile of distribution of the energised pumps and the rate of electrification of villages. Once a village is electrified, not all existing pumps are energised in the very first year, but the process is spread over a number of years with the highest number being energised in the 2nd, 3rd or 4th year (depending on the area). Given this pattern, the average number of energised pumpsets per village will depend on the number of new villages electrified each year in the past and in the years to come. For example, a sudden sharp increase in the number of newly electrified villages in a year will by itself have a lowering effect on the average number of pumpsets in the next year or two, but raise this average in the subsequent 2 or 3 years; a sudden sharp decline in the number of newly electrified villages will have the reverse impact. If data on total number of pumpsets energised every year were available separately for every group of villages which was electrified in particular years, that would have provided a better basis for our exercise in projection into the future. However, no such data are available to the Committee. We shall, therefore, depend on the simple average for all the electrified villages in each year. Table 2.5 gives the average number of pumpsets per village electrified, for each of the years 1974 to 1978, separately for every State. It appears that in some of the States, the number of pumpsets per electrified village remained practically unchanged over the five years 1974-78. In the case of such States, to start with, we assume that the number of pumpsets per electrified village in 1983 will be the same as in the past. There are other States where the number of pumpsets per electrified village registered a more or less steady rise over the five years. In their case, we assume the rising trend to continue and, therefore, estimate somewhat higher figures in March 1983. In the case of still another set of States, namely, Orissa, Assam, Bihar, West Bengal. etc., where electrically operated lifts were negligible in 1978, we presume greater arround efforts and, therefore, somewhat larger number of pumpsets per electrified village than in the past. The assumed figures of average number of electrical pumpsets per village

with electricity in March 1983, are given in col. 6 of Table 2.6. The estimated number of villages likely to be electrified by March 1983, and the average number of electrical pumpsets per electrified village, give us a third estimate of the expected total number of electrical pumpsets in the country in March 1983.

2.13 The three alternative estimates, one based on the projection of the linear growth rate of the total number of pumpsets in the States, the second based on the projection of the compound growth rate of the number of pumpsets, and the third based on a projected number of villages electrified and assumed number of pumpsets per electrified village, are given in Table 2.7 for all the States. For the country as a whole, the estimated total number of electrical pumpsets in March 1983 by the first method comes to 43.7 lakhs, by the second method to 50 lakhs and by the third method to 44.7 lakhs. Thus, we find that our alternative methods of estimation give a minimum of 10.7 lakh units and a maximum of 17 lakh units to be added to the existing number of electric pumpsets over a period of 5 years ending March 1983.

2.14 The alternate methods of estimation employed above are essentially extensions of past trends. It is obvious, however, that the past trends may not always continue in future either because of other factors constraining such expansion or because of operation of factors that may lead to better performance than in the past. It is necessary to take into account as many of these factors for which any information is available before making a final estimate of the demand for pumpsets during 1978-83. We attempt this for every State separately in the following paragraphs. Table 2.7 summarises the projections following the three alternative methods, and give in the last column our final estimate of additional demand in every State during 1978-83. Table 2.8 gives the estimates of the Planning Commission, the Central Electricity Authority and the State Electricity Boards.

2.15 Let us first take up the States where by now the task of reaching electricity to every village is complete or nearly so. In these States the expansion henceforth will be in the number of electrical pumpsets in already electrified villages, including conversion of the existing diesel operated pumpsets into electrically operated ones. The States are Punjab, Haryana, Kerala and Tamil Nadu. In Punjab, the linear growth rate of the number of electric pumpsets during 1974-78 was 16.3 thousand pumpsets a year. But, the actual number of electric pumpsets commissioned during 1976-77 and 1977-78 was much higher than in the earlier two years, 21.3 and 28.7 thousand units, respectively. The linear growth rate in such a case is, therefore, not useful. The compound growth rate gives 10.2 per cent growth per year, which suggests, on an average, an addition of about 24 thousand pumpsets a year. This is comparable with the actual number of pumpsets energised during each of the two years 1976-77 and 1977-78. The third approach estimates the number of villages likely to be electrified by March 1983 and the average number of electric pumpsets in the electrified villages by that date. The estimation of the average number of electrical pumpsets in a village is the only relevant projection to be made for this State. This average shows (Table 2.5) no particular trend and the highest annual average was 18. However, it is unlikely that this average will continue to be the same in the coming years. In the first place, by 1978 there were about 5 million hectares of net cultivated area in the State without any irrigation facility. Given the availability of underground water in the State and the great profitability of irrigated farming, it is not unreasonable to expect expansion

of tubewell irrigation to cover this area. It may be safely assumed that if all this area is to be brought under tubewell irrigation, anywhere between 60 and 80 thousand additional tubewells (with as many pumpsets) will be necessary. Most of these are likely to be electrically operated. Secondly, there is a growing use of underground water for irrigation in the areas already under the command of canals in the State. Demand for pumpsets for such supplementary irrigation is likely to increase particularly in areas which are liable or likely to be exposed to water-logging. It is difficult to estimate the number of such new tubewells/pumpsets. One may, however, guess some 10 to 20 thousand additional tubewells/pumpsets for this purpose during the current Plan period. Both these will add to the total number of existing pumpsets, diesel and electric, though the tubewells which supplement canal water may not necessarily add to the net irrigated area in the State. The third possibility of demand for electrical pumpsets is as substitutes for diesel pumps. Till 1974, there was a very substantial increase in the number of diesel pumpsets in the State, after which the expansion was more in the number of electric pumpsets. This was because of extension of rural electrification, on the one hand, and the rising price of diesel oil, on the other. Consequently, there has been a steady substitution of diesel pumpsets by electric ones in recent years. For example, the survey conducted by the ARDC for this Committee in the Punjab showed that almost all diesel pumpsets had been substituted by electric ones in the surveyed villages. The expansion in the number of electric pumpsets in the State cannot be considered to be all net additions to the total number of pumpsets. Some of them, in fact growing numbers, are sure to be substitutions for diesel engines. It is difficult, however, to estimate this demand during 1978-83. During the two years 1976-77 and 1977-78 the additional number of electric pumps installed was 50 thousand units which included both new demand and substitution of diesel by electric pumpsets. On this basis, the State Electricity Board and the Planning Commission have estimated some 150 thousand additional electric pumpsets during 1978-83. If we assume, as indicated earlier, that about 80 thousand new units will be demanded, for new as well as supplementary irrigation, then the official estimate implies some 70 thousand units as substitution for diesel engines. An official estimate puts the total number of diesel pumpsets in the State in 1978 at a little over 2.5 lakh units. In the light of this, substitution of some 70 thousand units of diesel by electric pumpsets in 5 years (1978-83), is not implausible. The rising relative price of diesel oil and the current State policy of charging for electric power at a flat rate based on the H.P. of the motor, are factors that would encourage such substitution. Farmers who have used their diesel engines for 6-7 years may not hesitate to substitute these by electric ones. But as against these favourable factors, there are others which may discourage such switchover. Punjab is a power-deficit State ; as against a 14 per cent increase in availability of electric power during 1979-83, the anticipation of 150 thousand additional pumpsets implies a 75 per cent increase in electric power required for pumping . This is likely to create shortages, which may discourage substitution. A more important factor is the shortage of material, particularly aluminium, for the State Electricity Boards to provide power connections to farms. The Committee has been informed by the representative of the REC that this may affect the plan for extension of power to farms for a couple of years\*. Moreover, farmers may sometimes find it convenient to use the same engine for pumping at different wells or tubewells on their farm ; diesel engine is more convenient than electric for such purposes. For all these, it may appear more

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\*It is a strange similarity that this is exactly what happened to the rural electrification programme during the first two years of the Fifth Plan. Ref. Draft Five Year Plan, 1978-83, p. 173, para 9.65.

reasonable to expect that 70 thousand may be the upper limit of electric units to substitute diesel pumpsets during 1978-83. This gives us a total estimated additional demand for electric pumpsets at 150 thousand units (80,000+70,000). This is not inconsistent with the reported performance of 36.67 thousand additional units during 1978-79. The provisional figure of additional electric pumpsets of 36.67 thousand units during 1978-79 is quite an encouraging performance but it cannot be expected to be sustained for future years.

2.16 All the villages in the State of Haryana have been electrified. On the basis of the linear growth rate of the total number of electric pumpsets in the State during 1974-78, one expects the total number at the end of March 1983 to be 212 thousand pumpsets, i.e., an increase of 46 thousand units over March 1978. On the basis of a compound growth rate for 1974-78, one can project the total number to be 229 thousand pumpsets by March 1983, i.e., 63 thousand more over March 1978. Alternatively, if one assumes the number of electric pumpsets per village to be 30 by March 1983, on the basis of a steady rising trend in this average from 19 to 25 during 1974-78, the total number of electric pumpsets would come to 202 thousand by March 1983, an increase of 36 thousand units over March 1978. We have no information about the estimates of the State Electricity Board for this State. The Central Electricity Authority expects 67 thousand new pumpsets during 1978-83, while the Plan estimation is of 75 thousand units. Before deciding on a forecast, it is necessary to examine the data on groundwater availability. The presently available information on groundwater potentiality with the ARDC suggests that if all the estimated groundwater recharge is to be used (without allowing any margin) then only about 65 thousand more pumpsets can be put up\*. Of course, over-exploitation of groundwater is not an unknown phenomenon. However, it is unlikely that this estimated potential will be fully tapped during the current Plan. Moreover, some substitution of existing diesel pumpsets by electric ones should be expected. On the other hand, these expectations have to be tempered by the fact that Haryana is expected to be a power-deficit State during the current Plan. As against a 22 per cent increase in power availability by 1983 (over 1979) a 35 per cent increase in demand for power by additional pumpsets is being anticipated by the Planners. Add to this, the anticipated shortage of materials for energisation. All these factors considered, we think 60 thousand additional electrical pumpsets during 1978-83 to be a fair estimate of demand. This is quite consistent with the reported achievement of 14.6 thousand units during 1978-79.

2.17 In the State of Kerala, rural electrification is nearly complete. There is also very considerable quantity of groundwater available. However, in March 1978, the State had less than 59 thousand electric pumpsets for irrigation. On the basis of the simple linear growth rate of these pumpsets during 1974-78, the projected number of pumpsets in March 1983 would be 86 thousand, i.e., 27 thousand units more. By projecting on the basis of the compound growth rate, the number in 1983 would be 105 thousand, i.e., 46 thousand units more. By assuming 60 electric pumpsets per village in 1983, as against the previous highest of 48 per village, we get an estimated total number of 76 thousand in March 1983, i.e., 17 thousand more during 1978-83. The State Electricity Board estimates an additional number of 79 thousand units, the Central Electricity Authority of 47 thousand units, and the Planning Body of 50 thousand units. These figures do not appear implausible. This is not a State with any anticipated shortage

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\* The State-wise estimates of groundwater recharge and use, available with the ARDC, are given in Table 2.9.



of electricity and therefore, this cannot be a constraint on the expansion of pumpsets. However, during the past four years the average annual rate of additions has been 5.4 thousand units and the best annual performance was not better than 6 thousand. What is more, during 1978-79, the additional units energised were only 7.31 thousand units as against the total of 17.7 thousand units planned by the Planning Commission as well as the State Electricity Board. Assuming that the effort will be stepped up in the next 4 years, it is fair to assume a total demand for 40 thousand units during the current Plan period.

2.18. The last of the four states with nearly 100 per cent rural electrification is the State of Tamil Nadu. On the basis of the linear and compound growth rates in the number of electric pumpsets in the State during 1974-78, it can be projected that the total number of pumpsets in March 1983 would be 976 thousand and 1014 thousand, respectively. If we assume 55 electric pumpsets per village, on the basis of the past rising trend in this average from 44 to 52 during 1974-78, then the projected number would come to 865 thousand only. The additional number of units during 1978-83, on the basis of the three alternative projections comes to 166,205 and 56 thousand units, respectively. As against these projections, the Planning Commission as well as the Central Electricity Authority expect between 125 and 150 thousand additional units during 1978-83. How reasonable are these various projections and estimates? The information at the disposal of the ARDC on unused groundwater potential shows that the bulk of the untapped potential is mainly in the four districts of Thanjavur, Pudukottai, Ramanathapuram and Kanyakumari. The other districts are either being over-exploited or have reached their limits. The district of Thanjavur has more groundwater than it may need for irrigation. Taking all these factors into account, we estimate a total demand of 80 thousand to 1 lakh new units during the current Plan period. Besides, there is sure to be some demand for electric pumpsets to replace existing diesel engine sets. We may expect this number to be no more than 50 thousand during the five years. This gives an estimated total of 130 to 150 thousand units (80 to 100 thousand new plus 50 thousand for substitution of diesel engine pumps). This is consistent with the reported achievement during the year 1978-79, when 33.4 thousand new units were installed as against 25 thousand units anticipated by the Planners and 57.8 thousand units by the State Electricity Board.

2.19 Now, turning to the other states in which 100 per cent rural electrification is not there and is not expected to be reached during the current Plan, we can broadly classify them into two groups; one in which the groundwater potentiality is considerable but which so far had only small exploitation of this resource and the other group consisting of states where the groundwater availability is comparatively less, but where the development of the resource has not been insignificant. We begin with the second group of states in the following.

2.20 Gujarat is a state in the second category. According to data on groundwater use available with the ARDC, nearly 55 per cent of the estimated potential was already being used in January 1977. There were 156 thousand electrical pumpsets in use in March 1978. On the basis of the linear and compound growth rates of the total number of pumpsets in the State during 1974-78, two projections can be made for March 1983 : 218 and 257 thousand units respectively, i.e., an increase of 62 and 101 thousand units over March 1978. A third alternative projection based on linear projection of the number of villages likely to be electrified by March 1983, and an assumed number of 20 pumpsets per village in 1983 as against the highest average of 19 in the past 5 years,

gives the total number of pumpsets of 217 thousand units, i.e., an increase of 61 thousand units over 1978. The State Electricity Board, on the other hand, expects an increase of about 136 thousand units, the Central Electricity Authority of 145 thousand units, and the Planning Commission of 130 thousand units. So far as groundwater availability is concerned, it is not a serious constraint on expansion during the next five years, nor is the availability of electricity likely to prove a deterrent since in this State no shortage of power is anticipated during the current Plan period. The real question is whether the State can keep up a compound growth rate of more than 10 per cent a year in the current Plan period. In recent years the number of additional electric pumpsets has risen from 16 thousand in 1976-77 to 18 thousand in 1977-78 and 22 thousand in 1978-79. The rising diesel price and the comfortable power supply position could help the rate of expansion. As against this, the comparative slow rate of rural electrification is partly due to shortage of material. Under the circumstances, one may reasonably expect an additional 125 thousand units during 1978-83.

2.21 Similarly, in Andhra Pradesh which had 338 thousand electric pumpsets in March 1978, the Planning Commission estimated 200 thousand additional units by 1983 and the Central Electricity Authority, 175 thousand units. On the other hand, our projections on the basis of the linear growth rate gave about 85 thousand additional units and the compound growth rate gave 114 thousand units. The third method of projection, on the basis of the projected number of electrified villages and estimated number of pumpsets per electrified village, gave a possible total increment of about 170 thousand units. Underground water is not yet a constraint in the State, nor is the expected availability of electric power, though shortage of materials is a current bottleneck. The real problem is the ability of the rural economy and the supporting institutions to translate the possibilities into actualities. Here we find that in the first year of the Plan, 1978-79, the number of new electrical pumpsets commissioned was 30 thousand units. In the light of the past performance, the target of 150 thousand units during 1978-83 appears feasible.

2.22 In the State of Maharashtra, there were 489 thousand electric pumpsets in March 1978. The projections on the basis of the three alternative growth rates, described earlier, gave 667, 760 and 694 thousand units by March 1983, i.e., increases of the order of 178, 271 and 205 thousand units, respectively. The expectations of the State Electricity Board, of the Central Electricity Authority and of the Planning Commission, are 249, 227 and 225 thousand units, respectively. The availability of groundwater does not appear to be a constraint for these targets. But electrical energy appears to be a real bottleneck; as it is, in summer the pumps do not get power for almost half the time. While the availability of electricity is expected to rise by 39 per cent by 1983, the official projections of demand for electric pumpsets is much in excess of this. Besides, there is the problem of shortage of materials. While the performance of energisation of pumpsets has been of the order of 49 thousand units in the year 1978-79, compared to the Planners' target of 37 thousand units, we shall not be unrealistic in projecting a total new addition of 200 thousand units by March 1983.

2.23 In the case of the State of Karnataka, our three alternative methods of projection give a total of 352, 393 and 348 thousand units of electric pumpsets by 1983, an increase of 89, 131 and 85 thousand units, respectively, over March 1978. The Planning Commission, the State Electricity Board and the Central Electricity Authority estimate

an addition of 130, 140 and 138 thousand units, respectively, these being comparable to our projection based on the compound growth rate over 1974-78. These projections are not inconsistent with the groundwater availability in the State. But Karnataka is a deficit State in regard to power supply. The experience of the first year of the Plan, 1978-79, is that in place of the projected 18 to 20 thousand additional pumpsets during the year, 15 thousand units had been added. Nor has the rate of rural electrification been better than in the past. While the Planners expected at least 650 villages to be electrified in the year, less than 300 had been electrified in the first 9 months. Thus, it would appear that our first and third alternative projections are the more likely estimates and are consistent with reported performance during 1978-79. We may, therefore, put the anticipated total additions at 90 thousand units during 1978-83.

2.24 Rajasthan is not a State with extensive groundwater resources, but according to data available with the ARDC, hardly 15 per cent of this is as yet tapped. The progress of installation of electric pumpsets has steadily improved in the past 4 or 5 years ; the number of newly installed electric pumpsets increased from 12 thousand in 1974-75 to 21 thousand in 1977-78. This makes the linear growth rate of 13 thousand units not very useful. The compound growth rate was about 13 per cent a year. Using these two growth rates to forecast the total number of electric pumps in 1983, we have 189 and 242 thousand units, respectively. These are 60 and 113 thousand units in excess of the 129 thousand at the end of March 1978. Estimation using our third alternative method gives 208 thousand units, i.e., an addition of 79 thousand units. Two of these projections are considerably short of the estimated additions of 114 and 120 thousand units derived by the Central Electricity Authority and the Planning Commission, respectively. They stipulate an increase of about 90 per cent in the total number of pumpsets, while the availability of electricity is likely to go up by only 21 per cent and that too in an acknowledged power-deficit State. The reported performance during 1978-79 has been an addition of 27 thousand units, much in excess of the figure anticipated. It would be difficult to project into the future on the basis of a single year's performance. But the current year's performance suggests that our projection on the basis of the compound growth rate is a plausible forecast, and one may reasonably expect about 100 thousand additional units during 1978-83.

2.25 It is necessary to remember that the projections attempted for the second group of states includes both newly installed electric pumpsets and electric motors which are likely to substitute existing diesel engines as a result of switchover. Separate estimates are, however, not possible in these cases.

2.26 We are now left with a third group of states with plenty of groundwater potential but very little exploitation of it so far. These are Assam, Bihar, West Bengal, Orissa, Madhya Pradesh and Uttar Pradesh. In these States, the problem is not one of availability of water, but of awareness about and urge for the possibilities and benefits of lift irrigation, of the necessary institutional structure and leadership at the ground level like cooperative credit societies and land development banks, of the efficiency of State and district administration in not only extension activity but also in helping in the promotion of lift irrigation among farmers, as well as in the provision of the necessary infrastructure like rural electrification, development of roads and communications, and of easily accessible points of supply of materials and equipment needed for the purpose. The relatively poor economic position of many of the State Governments puts further

limits on their initiative in all these fields. Besides, there is the problem of lack of proper record of rights in land, of tenancy, of fragmentation of land holdings and sometimes, of very small land holdings particularly in the paddy growing regions of these states. Because of these limitations, progress of lift irrigation and use of underground water for the purpose has been very slow in most of these states. And even when the financial institutions are willing to relax their normal requirements for sanctioning loans, cultivators or groups of them, have often failed to turn up in sufficient numbers, because they, in their turn, have not been sufficiently motivated to go in for it. It is unlikely that such urge will be visible over a wide range of the farming community until they see the very significant benefits in particular areas in their region. Until this happens the growth of lift irrigation will be comparatively slow; the speed will increase once this barrier of lack of awareness and motivation is broken. These basic characteristics of the states mentioned above have to be taken into account while projecting the demand for pumpsets in the next four or five years.

2.27 Let us begin with Assam. The State had 2176 villages, out of 21,995 electrified by March 1978. There were in all 1054 electrical pumpsets for irrigation in the State, giving an average of 0.48 pump per electrified village. The average number of new pumps energised per year during 1974-78 comes to less than 100 pumpsets, and the number of villages electrified per year to 270. As against this, the Planning Commission estimates an increase of 1700 electric pumpsets in 1978-79 and 5825 pumps per year for the next 4 years, giving 25 thousand electric pumpsets in 5 years. The Central Electricity Authority expected 400 units in 1978-79 and 5 thousand units in every one of the next 4 years, giving a total of 20,400 units more. These are quite different from the past trend. Of course, this is one of those situations where pulling a trend line to estimate the future is not at all useful. But it is necessary to estimate what is feasible. During the first six months of 1978-79, only 136 villages had been electrified, which was in keeping with the past trend. The total number of electric pumpsets installed during 1978-79 is reported to be 190, which is far from the projected 400 or 1700 units. Under the circumstances, it is difficult to visualise the likelihood of the electrification of nearly two thousand more villages every year for the next four years and the installation of at least 2 pumpsets per electrified village (a four fold increase over the present average) for the Planners' expectations to come true. The highest of our three alternative trend projections gives an addition of only 2500 electric pumps over the five years. With better effort one may expect a doubling of this, i.e., 5 thousand additional electrical pumpsets by 1983. If this happens, one may expect a better rate of growth in later years.

2.28 Next, in West Bengal, 11,669 villages (30.6 per cent of total) had been electrified by March 1978, and there were 20,346 electrical pumpsets. By our first and third methods of projection on the basis of past trends, we estimate 38 thousand pumpsets by March 1983, i.e., an addition of over 18 thousand new units in five years. But projecting on the basis of the compound growth rate, however, we have 97 thousand units, an increase of some 77 thousand units over March 1978. The official agencies appear to be far more hopeful in their expectations than our earlier two alternative projections. The State Electricity Board expects electrification of another 14 thousand villages and of 50 thousand pumpsets, the Central Electricity Authority of 47 thousand pumpsets and the Planning Commission of 70 thousand additional pumpsets by March 1983. During the period 1974-78, the average number of villages electrified per year was about 740. But the highest on record so far was in the two years 1972-74, when more than 5,300

villages were electrified. We understand that this was because of a different organisational set up under the State Electricity Board for the purpose during these two years. The same set up is now being reintroduced from April 1979. Therefore, the Board is hopeful of completing electrification of at least 2000 villages a year during the next four years. In fact, during the year 1978-79 only about 400 villages have been electrified. However, assuming the Board's expectations to be reasonable, we may expect some 9 thousand villages to be electrified in 5 years. The highest average number of electrical pumpsets per electrified village was 1.74 pumps in 1977-78, an increase of 130 per cent in 4 years. It is more difficult to visualise the same rate of growth in the number of pumps per electrified village being kept up during the next 5 years, since it is expected that there will be a three-fold increase in the number of villages electrified every year. Therefore, if we assume about 2.5 pumpsets per electrified village by March 1983, there will be in all, over 50 thousand pumpsets by then, giving an increase of 30 thousand units over the 5 years 1978-83. This gives an average of 6 thousand new electric pumpsets per year, which was the highest annual achievement during 1974-78 and much higher than the 1900 reported during 1978-79. We, therefore, think that 30 thousand additional electric pumpsets for West Bengal during 1978-83 is a liberal estimate.

2.29 The situation is even more difficult for the State of Orissa. More than 14 thousand villages had been provided with electrical supply lines by March 1978, but there were only 6400 electrical pumpsets in the State at that time. On the basis of past trends, we may project the total number of electric pumps to be 11, 19 and 22 thousand units, respectively (following the three alternative methods of projection). These give incremental demand of 5, 13 and 16 thousand units during 1978-83. Compared to these projections, the expectations of the three official agencies appear extremely optimistic : all the three agencies expect between 46 and 53 thousand additional pumpsets during 1978-83. While Orissa is not a State expected to run into deficit in power availability as against estimated demand by 1983, doubts have been expressed at the highest technical level in the State about the feasibility of the estimated demand for electric pumpsets. The past trend in village electrification has been about 1500 villages a year, while the State Electricity Board expects 2,200 villages a year during the current Plan. In fact, however, hardly 2 to 3 hundred villages are likely to have been electrified during 1978-79 and only about 1300 new electric pumpsets installed. This makes even the highest of our three estimates, 16 thousand additional units during 1978-83, appear optimistic, not to mention the official plans. Under the circumstances, we think the addition of 15 thousand units during 1978-83 will be a liberal expectation for the State.

2.30 Bihar had 18,204 villages with electric supply and 140 thousand electric pumpsets, giving an average of 7.7 pumpsets per electrified village. The linear growth rate of electrical pumpsets was 11 thousand units a year, giving a projected number of 198 thousand units by March 1983. The compound growth rate during 1974-78 gives a projected number of 232 thousand units. The average rate of addition to the number of villages electrified in the past was 2521 a year. Projecting the same growth rate into 1983 and assuming 10 pumps per electrified village by March 1983, we get a third estimate of 322 thousand electric pumpsets by 1983. The alternative projections give addition of 58, 92 and 182 thousand units during 1978-83. As against this, the official estimates range between 140 and 150 thousand additional units. Till 1978, electrical pumpsets had been located mainly in half a dozen of the 31 districts of the State, viz., Patna, Nalanda, Gaya, Nawadah, Aurangabad, Rohtas and Bhojpur, which together had one

lakh units. Interestingly enough, the State Electricity Board expects six of these seven districts (excluding Patna) to account for almost 107 of the 140 thousand new units likely to come up in the State. According to the data on ground water resources available with the ARDC, actual exploitation in Nalanda seems to be very near its total potential, yet the Board estimates considerable expansion here. The three districts with large untapped potential, Aurangabad, Bhojpur and Rohtas have comparatively less expansion anticipated. Similarly, districts with considerably large unused groundwater, like East and West Champaran, Madhubani, Monghyr, Saharsa, Purnea, as well as Ranchi and Santhal Parganas have rather smaller projections of electrified villages and pumpsets. While there is considerable potential in most districts, there is need for a better assessment of relative potentialities and corresponding effort to develop these. In actual fact, the experience during the first year of the current Plan, 1978-79, appears very disappointing. Only 3630 new electric pumpsets had been commissioned as against an average of 11 thousand units in the previous four years. Similarly, only 650 new villages had been provided with electricity during the first nine months giving an estimated 900 villages by the end of the year, as against an average of more than 2600 villages per year during 1974-78. This experience in the first year of the current Plan makes even our lower projections of 60 thousand additional units in 5 years appear highly optimistic. In the light of all these, we consider an addition of 50 thousand new electric pumpsets during 1978-83 as a very liberal estimate. This is a State endowed with considerable groundwater resources and in need of great improvement of agriculture. It is necessary to urgently examine the circumstances standing in the way of speedy achievement of these goals and to take prompt steps to prevent a slide down from the not very remarkable performance in the past.

2.31 Madhya Pradesh is another State in which hardly 10 per cent of the estimated groundwater recharge is currently being tapped. It had 216 thousand electric pumpsets in March 1978, and 16,350 villages provided with electricity giving an average of 13.2 pumpsets per village. Using the past linear and compound growth rates of the number of electric pumpsets in the State, we project additions of 116 and 242 thousand units, respectively, during 1978-83. Our third alternative projection based on 15 pumpsets per electrified village (as against the highest of 13.2 in 1978) and on the basis of the linear growth rate of villages electrified, gives about 121 thousand additional units, comparable to the projection based on the linear growth rate of villages electrified. As against these, the Central Electricity Authority and the Planning Commission estimated an increase of 240 to 250 thousand units. A detailed scrutiny of the projections of the State Electricity Board shows that in most of the districts the Board projects a doubling or more than doubling of the rate of installation of new electric pumpsets. These are not inconsistent with availability of groundwater. But what evidence is there to anticipate this sharp increase during the current Plan? During the first year of the current Plan, 1978-79, about 29 thousand new pumpsets were installed, which is in keeping with the performance of the earlier two years. If there is to be no slideback, then one may reasonably expect an increase in the rate in the last 2-3 years of the Plan period. We would, therefore, put the estimated additional number of electrical pumpsets at about 170 thousand units during 1978-83.

2.32 Finally, we turn to the State of Uttar Pradesh. It had about 299 thousand electric pumpsets in March 1978 in 35000 electrified villages, giving an average of 8.5 pumpsets per village, the highest so far. On the basis of past trends, our three alternative projections give two different figures for the number of additional electrical pumpsets during

1978-83, the first and third methods giving 72 thousand and the second method 95 thousand units. As against these, the Planning Commission and the Central Electricity Authority estimate a total addition of 275 thousand units in five years. We do not have the State Electricity Board's estimation of the district-wise extension plan. The data on groundwater shows that except for a few districts like Agra, Badaun and to a lesser extent Moradabad, where the limit of use has been reached or in Lalitpur and Nainital, where very little is available, practically every other district has considerable groundwater for tapping. The real constraints on expansion are some of the factors mentioned earlier. The experience of the first year, 1978-79, does not encourage one to accept the Plan targets. As against an expectation by the Central Electricity Authority of 34 thousand new electric pumpsets and by the Planning Commission of 40 thousand units, the actual achievement was 25 thousand units, the same as in the previous year. If the level of performance of the last two years, 1977-78 and 1978-79 is maintained and improved in the subsequent 4 years, an addition of about 140 thousand units during 1978-83 can be reasonably expected.

2.33 The remaining hill states of North-Eastern India, Himachal Pradesh and Jammu and Kashmir are States where lift irrigation potential is small, and no easy projections are feasible. In any case, the likely numbers are not so large as to make a significant difference to the all-India total. The same is more or less true of the Union territories. However, for the Union Territories we estimate an addition of 10 thousand units in five years.

TABLE 2.1 : NUMBER OF ELECTRICALLY OPERATED IRRIGATION PUMPSETS/TUBE-WELLS IN INDIA DURING 1966-78 (AS AT THE END OF MARCH)

State	1966	1969	1974	1975	1976	1977	1978
1	2	3	4	5	6	7	8
Andhra Pradesh ..	57225	123167	261989	275732	294017	306795	337546
Assam .. ..	—	55	705	776	1012	1054	1054
Bihar .. ..	10660	50005	96922	104034	118055	132322	139982
Gujarat .. ..	17155	42085	102683	113723	121854	137916	156028
Haryana .. ..	15220	45385	127947	134953	141885	153679	166631
Himachal Pradesh ..	88	306	1032	1202	1320	1415	1464
Janmu & Kashmir ..	104	162	402	417	744	789	834
Karnataka .. ..	42371	91826	189688	207667	224910	242471	262362
Kerala .. ..	6957	13909	37661	41549	47525	53148	58922
Madhya Pradesh ..	7314	24631	115560	133295	146739	180282	215925
Maharashtra .. ..	44978	124981	342265	380844	412068	448796	488706
Manipur .. ..	—	—	—	—	—	—	—
Meghalaya .. ..	—	—	—	—	5	18	47
Nagaland .. ..	—	—	1	1	1	1	1
Orissa .. ..	N.A.	477	2759	3490	4524	5428	6427
Punjab .. ..	25296	59157	129566	138902	146475	167815	196548
Rajasthan .. ..	6861	18362	74696	86793	93826	108080	128961
Sikkim .. ..	—	—	—	—	—	—	—
Tamil Nadu .. ..	256594	410119	681205	706914	742746	780816	809606
Tripura .. ..	—	2	40	40	99	126	145
Uttar Pradesh .. ..	17402	75659	233640	249480	260738	273025	298750
West Bengal .. ..	437	1199	6535	7694	10701	17132	20346
Union Territories ..	4069	7317	13509	14814	16629	18055	18961
<b>Total .. ..</b>	<b>512731</b>	<b>1088804</b>	<b>2418805</b>	<b>2602320</b>	<b>2785873</b>	<b>3029163</b>	<b>3309246</b>

Source : 'Role of R.E.C. in Irrigation,' published by the Rural Electrification Corporation.

2.34 A sum total of the state-wise projections by us, therefore, shows that one may reasonably expect an addition of about 15 lakh new electrical pumping units during the five years 1978-83. This is somewhat less than the 17 lakh new units projected by us by one of our three alternative methods, but is much lower than the 20 lakh units targeted by the Working Group of the Planning Commission. Our lower total estimate compared to the Commission's estimate is mainly due to the difference for the States of Bihar, Uttar Pradesh, West Bengal, Orissa, Madhya Pradesh and Assam. Our estimates for these States are based on assumption of a somewhat higher performance than in the past, but not as high as those made by the Commission and other agencies. The experience during the first year of the Plan does not appear to us to justify the Planning Commission's much higher hopes in this matter.

TABLE 2.2 : NUMBER OF ELECTRICALLY OPERATED PUMPSETS/TUBEWELLS ADDED EACH YEAR FROM 1974-75 TO 1978-79 (APRIL TO MARCH)

State	Number energised in				
	1974-75	1975-76	1976-77	1977-78	1978-79*
1	2	3	4	5	6
Andhra Pradesh ..	13,743	18,285	12,778	30,751	30,200
Assam .. ..	71	236	42	—	190
Bihar .. ..	7,112	14,021	14,267	7,660	3,630
Gujarat .. ..	11,040	8,131	16,062	18,112	21,770
Haryana .. ..	7,006	6,932	11,794	12,952	14,600
Himachal Pradesh ..	170	118	95	49	80
Jammu & Kashmir ..	15	327	45	45	NA
Karnataka .. ..	17,979	17,243	17,561	19,891	15,120
Kerala .. ..	3,888	5,976	5,623	5,774	7,310
Madhya Pradesh ..	17,735	13,444	33,543	35,643	28,920
Maharashtra .. ..	38,579	31,224	36,728	39,910	48,800
Manipur .. ..	—	—	—	—	—
Meghalaya .. ..	—	5	5	37	—
Nagaland .. ..	—	—	—	—	—
Orissa .. ..	731	1,034	904	999	1,290
Punjab .. ..	9,336	7,573	21,340	28,733	36,670
Rajasthan .. ..	12,097	7,033	14,254	20,881	27,400
Sikkim .. ..	—	—	—	—	—
Tamil Nadu .. ..	25,709	35,832	38,070	28,790	37,440
Tripura .. ..	—	59	27	19	50
Uttar Pradesh .. ..	15,840	11,258	12,287	25,725	25,440
West Bengal .. ..	1,159	3,007	6,431	3,214	2,000
Union Territories ..	1,305	1,815	1,426	906	600+
<b>Total</b>	<b>183,515</b>	<b>183,553</b>	<b>243,282</b>	<b>280,091</b>	<b>301,510</b>

\* Provisional

+ As on 31-12-1978.

Source : Rural Electrification Corporation.



TABLE 2.3 : PROJECTION OF DEMAND FOR ELECTRICAL PUMPSETS FOR THE PERIOD 1978-83

(Number of pumps in '000s)

State	No. of pump-sets in March 1978	Actual rate of growth 1974-78		Projected Number in March 1983 based on		Increase over 1978	
		(No. per year)*	(Per-cent/year)+	Col 3	Col 4	As per Col. 5	As per Col. 6
1	2	3	4	5	6	7	8
Andhra Pradesh ..	337.55	18.22	6.14	422.74	451.84	85.19	114.29
Assam ..	1.05	0.10	11.10	1.60	1.97	0.55	0.92
Bihar	139.98	11.44	9.76	198.35	231.90	58.37	91.92
Gujarat ... ..	156.03	13.09	10.30	218.06	257.17	62.03	101.14
Haryana ..	166.63	9.61	6.58	212.28	228.89	45.65	62.26
Himachal Pradesh .. ..	1.46	0.11	8.62	2.04	2.34	0.58	0.88
Jammu & Kashmir ..	0.83	0.12	20.97	1.50	2.63	0.67	1.80
Karnataka ..	262.36	18.02	8.04	351.53	393.11	89.17	130.75
Kerala .. ..	58.92	5.41	11.41	85.65	104.81	26.73	45.89
Madhya Pradesh .. ..	215.93	24.77	15.52	331.76	457.90	115.83	241.97
Maharashtra .. ..	488.71	36.08	8.77	667.12	759.81	178.41	271.10
Orissa	6.43	0.93	21.33	11.02	19.27	4.59	12.84
Punjab .. .. .	196.55	16.29	10.23	269.88	315.29	73.33	118.74
Rajasthan .. ..	128.96	12.98	13.12	189.34	242.31	60.38	113.35
Tamil Nadu .. ..	809.61	33.07	4.45	975.75	1014.11	166.14	204.50
Tripura .. .. .	0.15	0.03	37.23	0.30	1.10	0.15	0.95
Uttar Pradesh .. ..	298.75	15.38	5.82	370.76	394.04	72.01	95.29
West Bengal .. ..	20.35	3.71	30.72	38.42	97.39	18.07	77.04
Union Territories ..	18.96	1.41	8.76	26.30	30.03	7.34	11.07
<b>Total</b>	<b>3309.21</b>	—	—	<b>4374.40</b>	<b>5005.91</b>	<b>1065.19</b>	<b>1696.70</b>

\* Linear.

+ Compound.

**TABLE 2.4 : NUMBER OF VILLAGES PROVIDED WITH ELECTRICITY DURING EACH YEAR FROM 1974-75 TO 1977-78 (APRIL-MARCH)**

State	Total No. of villages electrified by March 1974	Additional number of villages electrified during				Total No. of villages electrified by March 1978	Total No. of villages as per 1971 census
		1974-75	1975-76	1976-77	1977-78		
1	2	3	4	5	6	7	8
Andhra Pradesh .. .. .	10262	204	892	2112	1182	14,652 (53.8)	27,221
Assam .. .. .	1146	213	410	228	179	2,176 (10.0)	21,995
Bihar .. .. .	9605	541	6419	1595	44	18,204 (26.9)	67,566
Gujarat .. .. .	5676	350	281	801	1013	8,121 (44.4)	18,275
Haryana .. .. .	6731	—	—	—	—	6,731 (100.0)	6,731
Himachal Pradesh .. .. .	4500	1776	445	525	507	7,753 (45.8)	16,916
Jammu & Kashmir	1380	354	462	633	1185	4,014 (61.7)	6,503
Karnataka	12644	1086	479	494	457	15,160 (56.5)	26,826
Kerala .. .. .	1173	9	20	10	12	1,224 (96.5)	1,268
Madhya Pradesh	10703	601	518	2007	2521	16,350 (23.1)	70,883
Maharashtra	16933	1886	490	897	1274	21,480 (60.0)	35,778
Manipur .. .. .	213	4	18	—	—	235 (12.1)	1,949
Meghalaya	137	—	124	77	58	396 (8.6)	4,583
Nagaland .. .. .	136	20	19	24	37	236 (24.6)	960
Orissa	8077	2051	1379	1554	1100	14,161 (30.1)	46,992
Punjab	7078	639	2209	2200	—	12,126 (99.5)	12,188
Rajasthan	5778	548	727	1308	1648	10,009 (30.1)	33,305
Sikkim	N.A.	N.A.	N.A.	22	20	48 (22.3)	215
Tamil Nadu	15455	18	36	7	6	15,522 (98.6)	15,735
Tripura .. .. .	103	22	45	120	120	410 (8.7)	4,727
Uttar Pradesh .. .. .	29765	1033	1064	1236	1928	35,026 (31.1)	112,561
West Bengal .. .. .	8708	762	355	1156	688	11,669 (30.6)	38,074
Union Territories	966	73	53	27	76	1,195 (25.5)	4,685
<b>All India .. .. .</b>	<b>157,107</b>	<b>12,252</b>	<b>16,451</b>	<b>17,033</b>	<b>14,055</b>	<b>216,898 (37.7)</b>	<b>575,936</b>

In Col. 7, the figures in brackets indicate the percentage of villages electrified in each state as on 31, March 1978.

**TABLE 2.5: AVERAGE NUMBER OF ELECTRIC PUMPSETS PER ELECTRIFIED VILLAGE AS AT THE END OF MARCH (1974 TO 1978)**

State	Number of electric pumpsets per electrified village				
	1974	1975	1976	1977	1978
1	2	3	4	5	6
Andhra Pradesh	25.53	26.35	25.89	22.78	23.04
Assam	0.62	0.57	0.57	0.53	0.48
Bihar	10.09	10.25	7.13	7.29	7.69
Gujarat	18.09	18.87	19.32	19.40	19.21
Haryana ..	19.01	20.05	21.08	22.83	24.76
Himachal Pradesh	0.23	0.19	0.20	0.20	0.19
Jammu & Kashmir	0.29	0.24	0.34	0.28	0.21
Karnataka	15.00	15.30	15.83	16.49	17.31
Kerala ..	32.11	35.15	39.54	43.85	48.14
Madhya Pradesh	10.80	11.79	12.41	13.04	13.21
Maharashtra	20.21	20.24	21.34	22.21	22.75
Manipur .. ..	—	—	—	—	—
Meghalaya ..	—	—	—	0.08	0.12
Nagaland .. ..	—	—	—	—	—
Orissa .. ..	0.34	0.34	0.39	0.42	0.45
Punjab ..	18.31	18.00	14.76	13.84	16.21
Rajasthan	12.93	13.72	13.30	12.93	12.88
Sikkim ..	—	—	—	—	—
Tamil Nadu	44.00	45.69	47.89	50.32	52.16
Tripura ..	0.39	0.32	0.58	0.43	0.35
Uttar Pradesh	7.85	8.10	8.18	8.25	8.53
West Bengal	0.75	0.81	1.09	1.56	1.74
Union Territories	13.98	14.26	15.23	16.13	15.87
<b>All India .. ..</b>	<b>15.49</b>	<b>15.37</b>	<b>14.99</b>	<b>14.95</b>	<b>15.31</b>

**TABLE 2.6 : PROJECTION OF THE NUMBER OF ELECTRIC PUMPSETS BASED ON VILLAGE ELECTRIFICATION**

State	Total number of villages as per 1971 census	Number of villages electrified as at the end of March 1978	Annual growth rate in number of villages electrified during 1974-78	Estimated number of villages likely to be electrified by March 1983 (based on Col. 4)	Estimated number of pumpsets per electrified village by March 1983 (based on Table 2.4)	Expected total number of electric pumpsets (Col. 5 & Col. 6)
1	2	3	4	5	6	7
Andhra Pradesh	27,221	14,652	1,178	20,290 (75)	25	5,07,250
Assam	21,995	2,176	270	3,578 (16)	1	3,578
Bihar	67,566	18,204	2,521	32,184 (48)	10	3,21,840
Gujarat	18,275	8,121	597	10,828 (59)	20	2,16,560
Haryana .. ..	6,731	6,731	A	A	30	2,01,930
Himachal Pradesh ..	16,917	7,753	748	11,732 (69)	1	11,732
Jammu & Kashmir	6,503	4,014	B	B	1	—
Karnataka .. ..	26,826	15,160	600	18,293 (68)	19	3,47,567
Kerala .. ..	1,268	1,224	A	A	60	76,080
Madhya Pradesh ..	70,883	16,350	1,382	22,475 (32)	15	3,37,125
Maharashtra	35,778	21,480	1,048	26,686 (75)	26	6,93,836
Manipur .. ..	1,949	235	B	B	—	—
Meghalaya .. ..	4,583	396	B	B	—	—
Nagaland .. ..	960	236	B	B	—	—
Orissa .. ..	46,992	14,161	1,510	21,958 (47)	1	21,958
Punjab .. ..	12,188	12,126	A	A	18	2,19,384
Rajasthan .. ..	33,305	10,009	1,050	14,853 (45)	14	2,07,942
Sikkim .. ..	215	48	B	B	—	—
Tamil Nadu	15,735	15,522	A	A	55	8,65,425
Tripura	4,727	410	78	765 (16)	1	765
Uttar Pradesh	112,561	35,026	1,282	41,085 (37)	9	3,69,765
West Bengal	38,074	11,669	743	15,333 (40)	2.5	38,333
Union Territories ..	4,685	1,195	54	1,459 (31)	18	26,244
<b>All India</b>	<b>575,936</b>	<b>216,946</b>	—	—	—	<b>44,67,314</b>

Note : A—The State has achieved almost 100% village electrification.  
 B—The demand is not estimated as it is small.  
 Figures in brackets in Column 5 indicate percentage of villages to be electrified by March 1983.

TABLE 2.7 : PROJECTED NUMBER OF ADDITIONAL ELECTRIC PUMPSETS FOR THE PERIOD 1978-83

(Number in '000s)

State	Number of electric pumpsets as on 31-3-1978	Expected number of pumpsets in March 1983			Expected increase during 1978-83		
		(a)	(b)	(c)	(a)	(b)	(c)
1	2	3	4	5	6	7	8
Andhra Pradesh .. .. .	337.55	422.74	451.84	507.25	85.19	114.29	169.70
Assam .. .. .	1.05	1.60	1.97	3.58	0.55	0.92	2.53
Bihar .. .. .	139.98	198.35	231.90	321.84	58.37	91.92	181.86
Gujarat .. .. .	156.03	218.06	257.17	216.56	62.03	101.14	60.53
Haryana .. .. .	166.63	212.98	228.89	201.93	45.65	62.26	35.40
Himachal Pradesh .. .. .	1.46	2.04	2.34	11.73	0.58	0.88	10.27
Jammu & Kashmir .. .. .	0.83	1.50	2.63	—	0.67	1.80	—
Karnataka .. .. .	262.36	351.53	393.11	347.57	89.17	130.75	85.21
Kerala .. .. .	58.92	85.65	104.81	76.08	26.73	45.89	17.16
Madhya Pradesh .. .. .	215.93	331.76	457.90	337.13	115.83	241.97	121.20
Maharashtra .. .. .	488.71	667.12	759.81	693.84	178.41	271.10	205.13
Orissa .. .. .	6.43	11.02	19.27	21.96	4.59	12.84	15.53
Punjab .. .. .	196.55	269.88	315.29	219.38	73.33	118.74	22.83
Rajasthan .. .. .	128.96	189.34	242.31	207.94	60.38	113.35	78.98
Tamil Nadu .. .. .	809.61	975.75	1014.11	865.42	166.14	204.50	55.81
Tripura .. .. .	0.15	0.30	1.10	0.77	0.15	0.95	0.62
Uttar Pradesh .. .. .	298.75	370.75	394.04	369.77	72.01	95.29	71.02
West Bengal .. .. .	20.35	38.42	97.39	38.33	18.07	77.04	17.98
Union Territories .. .. .	18.96	26.30	30.03	26.24	7.34	11.07	7.28
<b>All India .. .. .</b>	<b>3309.21</b>	<b>4374.40</b>	<b>5005.91</b>	<b>4467.31</b>	<b>1065.19</b>	<b>1696.70</b>	<b>1158.94</b>

State	Percentage of estimates for 1983 over 1978 actuals			Percentage of power availability in 1983 over 1979	Final estimates of additions during 1978-83
	(a)	(b)	(c)		
1	9	10	11	12	13
Andhra Pradesh .. .. .	125	134	150	147	150
Assam .. .. .	145	177	326	—	5
Bihar .. .. .	142	166	230	140	50
Gujarat .. .. .	140	165	139	130	125
Haryana .. .. .	127	137	121	122	60
Himachal Pradesh .. .. .	142	166	782	120	5
Jammu & Kashmir .. .. .	181	317	—	—	—
Karnataka .. .. .	134	150	132	124	90
Kerala .. .. .	145	178	129	113	40
Madhya Pradesh .. .. .	154	212	156	145	170
Maharashtra .. .. .	137	155	142	139	200
Orissa .. .. .	171	296	338	—	15
Punjab .. .. .	137	160	112	114	150
Rajasthan .. .. .	147	188	172	121	100
Tamil Nadu .. .. .	121	125	107	117	150
Tripura .. .. .	200	733	513	—	—
Uttar Pradesh .. .. .	124	132	124	125	140
West Bengal .. .. .	189	476	189	164	30
Union Territories .. .. .	138	158	133	—	10
<b>All India .. .. .</b>					<b>1490</b>

(say 15 lakhs)

- (a) : Based on projection of linear growth rate of total number of pumpsets in the State.  
 (b) : Based on projection of compound growth rate of total number of pumpsets in the State.  
 (c) : Projection based on linear growth rate of number of villages electrified and number of electrical pumpsets per electrified village.

TABLE 2.8 : ENERGISATION OF PUMPSETS DURING 1978-79 TO 1982-83  
(TARGETS AND ACTUALS)

(Number in '000s)

State	VI Plan Targets			Targets by CEA					
	1978-79	1979-80 to 1982-83 each year	Total	1978-79	1979-80 to 82-83 each year	Total			
	1	2	3	4	5	6	7		
Andhra Pradesh	..	..	..	30.0	42.5	200.0	15.0	40.0	175.0
Assam	..	..	..	1.7	5.8	24.9	0.4	5.0	20.4
Bihar	..	..	..	21.0	32.3	150.2	25.0	30.0	145.0
Gujarat	..	..	..	22.5	26.9	130.1	25.0	30.0	145.0
Haryana	..	..	..	24.0	12.8	75.2	7.0	15.0	67.0
Himachal Pradesh	..	..	..	0.1	0.4	1.7	0.2	0.3	1.4
Jammu & Kashmir	..	..	..	0.1	0.1	0.5	(65)	0.1	0.5
Karnataka	..	..	..	18.0	28.0	130.0	18.0	30.0	138.0
Kerala	..	..	..	17.7	8.1	50.1	7.0	10.0	47.0
Madhya Pradesh	..	..	..	50.0	50.0	250.0	40.0	50.0	240.0
Maharashtra	..	..	..	37.0	47.0	225.0	27.0	50.0	227.0
Orissa	..	..	..	1.8	12.0	49.8	6.0	10.0	46.0
Punjab	..	..	..	32.0	22.0	120.0	28.0	24.0	124.0
Rajasthan	..	..	..	21.0	24.8	120.2	14.0	25.0	114.0
Tamil Nadu	..	..	..	25.0	25.0	125.0	30.0	30.0	150.0
Tripura	..	..	..	0.1	0.2	0.9	(65)	0.2	0.9
Uttar Pradesh	..	..	..	40.0	58.8	275.2	34.0	60.0	274.0
West Bengal	..	..	..	10.0	15.0	70.0	7.0	10.0	47.0
Union Territories	..	..	..	1.0	0.3	2.2	—	—	—
All India	..	..	..	353.0	411.8	2000.2	284.0	421.0	1968.0

State	Targets by SEBs						Actual* achievement in 1978-79	
	1978-79	1979-80	1980-81	1981-82	1982-83	Total		
	8	9	10	11	12	13		14
Andhra Pradesh	..	45.0	55.0	55.0	55.0	55.0	255.0	30.2
Assam	..	—	—	—	—	—	—	0.2
Bihar	..	15.0	22.2	27.9	33.3	41.3	139.7	3.6
Gujarat	..	33.2	24.9	26.0	26.0	26.0	136.1	21.8
Haryana	..	—	—	—	—	—	—	14.6
Himachal Pradesh	..	0.1	0.1	0.1	0.1	0.1	0.5	0.1
Jammu & Kashmir	..	—	—	—	—	—	—	—
Karnataka	..	20.0	30.0	30.0	30.0	30.0	140.0	15.1
Kerala	..	17.7	16.7	15.0	15.0	15.0	79.4	7.3
Madhya Pradesh	..	53.0	53.0	53.0	53.0	53.0	265.0	28.9
Maharashtra	..	37.8	53.3	52.7	52.0	53.1	248.9	48.8
Orissa	..	2.5	4.9	4.5	13.0	28.0	52.9	1.3
Punjab	..	30.0	30.0	30.0	30.0	30.0	150.0	36.7
Rajasthan	..	—	—	—	—	—	—	27.4
Tamil Nadu	..	57.8	50.0	50.0	50.0	50.0	257.8	33.4
Tripura	..	—	—	—	—	—	—	0.1
Uttar Pradesh	..	—	—	—	—	—	—	25.4
West Bengal	..	10.0	10.0	10.0	10.0	10.0	50.0	1.9
Union Territories	..	1.8	2.1	2.2	2.3	2.1	10.5	—
All India	..	323.9	352.2	356.4	369.7	393.6	1795.8	296.6

— : Information not available.  
 Figures in brackets are actual numbers.  
 CEA : Central Electricity Authority.  
 SEB : State Electricity Board.  
 \* Provisional figures.

TABLE 2.9 : GROUND WATER POTENTIAL (POSITION AS ON 1-1-1978)

(Million Cubic Meters)

State	Annual recharge	Annual draft	Balance	Col. 4 as percentage of Col. 2
1	2	3	4	5
Andhra Pradesh .. ..	30982	7607	23375	75
Assam	11640	64	11576	99
Bihar* .. ..	28720	5204	23516	82
Gujarat* ..	12955	4317	8638	67
Haryana* .. ..	11255	7531	3724	33
Himachal Pradesh	NA	NA	NA	—
Jammu & Kashmir ..	NA	NA	NA	—
Karnataka .. ..	9718	2567	7151	74
Kerala* .. ..	7053	361	6692	95
Madhya Pradesh* ..	43395	3407	39988	92
Maharashtra* ..	22926	8132	14794	65
Orissa ..	13310	1364	11946	89
Punjab* .. ..	9791	5369	4422	45
Rajasthan	17549	2521	15028	86
Tamil Nadu ..	18245	19326	—1082	—
Uttar Pradesh	61493	28306	33187	54
West Bengal*	21569	5266	16303	76

\* The position as on 1-1-1977.  
Source : ARDC

## CHAPTER III

### DEMAND FOR DIESEL PUMPSETS

3.1 Estimation of the demand for diesel pumpsets presents greater difficulties, because data on the number of pumpsets installed for irrigation during the last 6-7 years are not readily available. Firm official figures for the total number of diesel pumpsets in use for irrigation in different states are available on a quinquennial basis from the livestock census. The latest census year for which the data are available is 1972\*. In the absence of official statistics for the years since 1972, it would have been possible to attempt an estimation of the annual additions to this number, if at least information on the number of new pumpsets financed by them could be made available by the commercial banks, the State Land Development Banks and the Co-operative Banks for the individual years since 1972. However, even this information was not readily available. Our efforts to obtain data on number of units for which loans were extended every year, drew very poor response. Only three State Land Development Banks came forward with some information; no commercial bank could favour us with any information. We understand that data on number of pumpsets financed and the amount of loans actually disbursed each year are being compiled by the commercial banks only during the last couple of years. Consequently we have been able to get some data relating to the financing of pumpsets by these three types of financial institutions from the Reserve Bank of India for the year 1977-78 only, which, however, do not help us to estimate the progress in the total number of diesel pumpsets in India after 1972.

3.2 The Committee had, therefore, to resort to other methods of estimating the total additions to the stock of diesel pumpsets. One method suggested to us is the following. An inevitable component of the diesel engine that operates an irrigation pump is the single cylinder fuel injection pump. Therefore, given the total number of single cylinder fuel injection pumps sold in the Indian market, it should be possible to estimate the total number of diesel engines produced and marketed in the country from year to year.

3.3 There are only three manufacturers of fuel injection pumps in India; for many years now there has been no import of this equipment. Of the three manufacturers of fuel injection pumps, only two are relevant for our purpose, since the third manufactures fuel injection pumps that are not used in making diesel engines used for irrigation purposes. Table 3.1 gives the total number of single cylinder fuel injection pumps produced by the two manufacturers, the number exported by them, and the balance sold in the internal market, largely as original parts to manufacturers of oil engines and, to a small extent, as spare parts to dealers.

3.4 In order to estimate the total number of oil engines actually sold every year for purpose of irrigation, on the basis of the number of single cylinder fuel injection pumps sold to diesel engine manufacturers, a number of adjustments have to be made to take account of changes in inventories, of exports, and of sales of engines for uses other than irrigation. No information is available on any of these, except exports. We explain below the basis of the adjustments made by us on these counts.

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\* The data from the 1976 livestock census are not yet available.



3.5 We assume that the manufacturers of diesel engines keep about one month's requirement of fuel injection pumps as inventory with them. This is possibly an over-estimation for the large manufacturers. It is also likely that the very small assemblers of diesel engines and pumps keep very little inventory of components. However, we take it as an overall average for all—the petty assemblers and the small as well as large manufacturers. The estimated figures with some adjustments, are given in Col. 3 of Table 3.2.

3.6 Similarly, we assume that the total number of manufactured diesel engines held in stock by the manufacturers and their dealers, as well as in the pipeline would amount to about one month's total production during the year. It is possible that for the large manufacturers, this is an underestimate. This figure is given in Col. 5 of Table 3.2.

3.7 We now turn to the estimation of export of diesel engines. The "Monthly Statistics on Foreign Trade of India" gives the number of pumpsets with diesel engines as well as diesel engines of various B.H.P. exported every year. We have listed in Col. 2 of Table 3.3 the total number of oil engines of less than 100 B.H.P. exported, and in Col. 3 of the table the approximate number of oil engines of less than 15 B.H.P. exported\*. These latter engines are fitted with single cylinder fuel injection pumps and they account for the bulk of the oil engines exported. These engines of less than 15 B.H.P. are also more relevant for our purpose. Besides export of whole engines, there is considerable export of what is listed as "Oil engine spares". Its total value has often been almost as high as the total value of all oil engines exported. It is possible that many of these spares constitute nothing but whole oil engines exported in knocked-down condition. We have converted the value of these "Oil engine spares" into units of whole engine at the minimum export price of whole engines and thus arrived at a rough estimate of the number of oil engines exported in knocked-down condition. This is given in Col. 4 of Table 3.3. The number of oil engines with pumps, i.e. whole pumpsets exported is given in Col. 5. The total number of oil engines (with single cylinder fuel injection pumps) exported is thus estimated in Col. 7 of Table 3.3, and reproduced in Col. 6 of Table 3.2.

3.8 Besides exporting oil engines, we learn from the manufacturers that they export certain number of fuel injection pumps as spares with these engines. We assume this export of fuel injection equipment to be about 10 per cent of the total number of engines exported. This is given in Col. 7 of Table 3.2. After adjusting for the changes in inventories, and export of oil engines and fuel injection equipment, we arrive at the estimate of the total number of diesel engines, with single cylinder fuel injection pumps, sold in the local market. This is given in Col. 8 of Table 3.2.

3.9 However, not all these engines are used for irrigation. There are a number of other purposes to which these engines are put, like in concrete mixers, stone crushers, vibrators, pneumatic air compressors, small power generators, and in marine crafts and oil tankers on roads. However, no information on the purchase of oil engines for such purposes is available. On the basis of the conjectures of some manufacturers and the growing demand for non-agricultural purposes to which such engines are put, we assume that 15 per cent of the total number of oil engines sold in the country are used for such non-irrigation purposes. The estimated number of new oil engines purchased for pumping water for irrigation is given in Col. 9 of Table 3.2.

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\*In some cases the figures relate to oil engines of less than 20 B.H.P.; since separate figures for such engines with less than 15 B.H.P. are not available.

3.10 It is necessary to emphasise that this estimate of the annual addition to the total number of diesel engine operated pumps is subject to possible errors arising out of our conjectural adjustments for inventory changes and non-irrigation uses. All the same, we think that in the absence of any alternative firm data, this method helps us arrive at a fair estimate of the number of diesel pumpsets installed for irrigation every year. Nevertheless, we thought it useful to compare our estimates arrived at in this manner, with the figure of additions to the total number of diesel pumpsets arrived at from the data from the two livestock censuses, 1966 and 1972. According to the livestock census, there were 471 thousand diesel engine pumpsets in agriculture in April 1966. By April 1972 this had increased to 1628 thousand. This gives a net addition of 1157 thousand units. The number of additions would be in fact slightly less since the data for Karnataka relates to November 1972 and for Tamil Nadu to March 1974. Nevertheless, this figure compares very well with the estimate arrived at following our method of estimation. The estimated number of diesel engines added during 1966-72 by our method, comes to 1170 thousand units. Therefore, we can say that our method of estimation of additions to the stock of diesel engines is a reasonable one. We, therefore, use this method to estimate the annual additions to the total number of diesel engine pumpsets in the period after 1972.

3.11 By following our method of estimation, we find that during the 5 years, 1973-78, a total of 1236 thousand diesel pumpsets were newly installed. This gives an average of about 250 thousand units a year. But the data in the last column of Table 3.2 show that after the first 3 years, the number has been smaller than this average. It is likely that this somewhat lower rate of additions will be the pattern in the next 4-5 years. The main reason is the expanding rural electrification which leads to a demand for electric pumpsets rather than diesel engine operated pumps. Rural electrification has expanded the most in some of those states which had the highest number of diesel pumpsets. These are Tamil Nadu and Punjab which have now almost complete rural electrification, and States like Maharashtra, Gujarat and Andhra Pradesh where rural electrification is proceeding apace. In 1972, the four States of Tamil Nadu, Maharashtra, Gujarat and Punjab accounted for nearly 70 per cent of the total number of diesel pumpsets in rural India. And the larger rate of annual additions had been in these states. There is reason to believe that this pattern has begun to change. Not merely is additional potentiality for lifting ground and surface water for irrigation dwindling in some of them, but rural electrification is bound to result in reduced demand for diesel engines.

3.12 As against the prospect of decline in the demand for diesel engines in some states, one may anticipate an accelerated growth of demand in some others, like U.P., Rajasthan, M.P., Bihar and West Bengal. The last four states and Eastern U.P. are late starters in lift irrigation, but they are now picking up. And in all these states, the anticipated rate of rural electrification will leave almost 50 per cent of the villages without electricity by 1983. Consequently, there will be an increasing demand for diesel pumpsets. It is, however, doubtful that the increased demand in these and some of the other states, will be large enough to more than offset the declining trend in the earlier group of states. This may be so, because, firstly, diesel oil will become more expensive in the coming years, and, secondly, these are States in which the rate of expansion may not be as fast, at least in the next 4 or 5 years, as it was in the first group of states in the earlier years. Therefore, we believe that the total additional demand is not likely to go up during the next few years.

3.13 Our estimates in Table 3.2 suggest an addition of 2.36 lakh units during 1977-78. We believe that the annual average requirement of the additional diesel pumps during 1978-83 will be of this order. This implies that during the 5 years of the current Plan, the total number of additional diesel pumpsets likely to be demanded would be between 11.5 and 12 lakh units. Let us put it at 12 lakh units.

3.14 The bulk of these will be required in the States of Rajasthan, M.P., U.P., Bihar, West Bengal, Andhra Pradesh and to a lesser extent, in Maharashtra. We present in Table 3.5, a rough estimate of the number of diesel pumpsets sold in the states during the year 1977-78. These estimates are based on a variety of information, including State-wise data on loans disbursed by the financing institutions during 1976-77 and 1977-78, data on electrification of pumpsets, data from the Kirloskar Oil Engines who have shared with us their estimates of regional production pattern and the market shares of different states.

TABLE 3.1 : SINGLE CYLINDER FUEL INJECTION PUMPS SOLD IN INDIA

(Number in '000s)

Year	Motor Industries Co. Ltd.				Sale by Fuel Injection Ltd.	Total sales as original parts (Cols. 5+6)
	Total Production	Total Exports	Total sold as spares	Total sold as original parts		
1	2	3	4	5	6	7
1966	189	—	14	173	7	180
1967	209	—	24	185	10	195
1968	301	—	40	249	16	265
1969	345	—	15	341	25	366
1970	271	10	52	214	10	224
1971	265	15	18	225	15	240
1972	219	26	12	191	17	208
1973	364	45	3	310	40	350
1974	463	104	13	354	28	382
1975	548	98	7	424	49	473
1976	320	112	5	209	46	255
1977	521	184	7	329	49	378
1978	561	118	8	438	56	494

Source : Data supplied by the two manufacturers.

**TABLE 3.2 : ESTIMATED NUMBER OF OIL ENGINES SOLD FOR IRRIGATION PURPOSES**

(Number in '000s)

Year	No. of F.I.E. sold (Col. 7 of Table 3.1)	No. of F.I.E. in stock at end of the year	No. of O.E. produced	No. of O.E. in stock at end of the year	No. of O.E. exported	No. of F.I.E. exported as spares	No. of O.E. sold to users in India	Of which sold for irrigation purpose
1	2	3	4	5	6	7	8	9
1966-67	180	15	165	14	3.5	0.35	147.15	125.08
1967-68	195	16	194	16	3.9	0.39	187.71	159.55
1968-69	265	22	259	22	7.2	0.72	245.08	208.32
1969-70	366	30	258	30	8.7	0.87	340.43	289.37
1970-71	224	30	224	19	11.3	1.13	222.57	189.18
1971-72	240	20	250	21	13.4	1.34	233.26	198.27
1972-73	208	20	208	20	19.8	1.98	187.22	159.14
1973-74	350	29	341	28	34.6	3.46	294.94	250.70
1974-75	382	32	379	32	66.0	6.60	302.40	257.04
1975-76	473	40	465	39	65.5	6.55	385.95	328.06
1976-77	255	30	265	25	80.0	8.00	194.00	164.90
1977-78	378	31	377	31	82.5	8.25	277.25	235.66
1978-79	494	41	484	40	—	—	—	—

*Note :* O.E. : Oil Engines  
FIE : Fuel Injection Equipment.

**TABLE 3.3 : EXPORT OF OIL ENGINES FITTED WITH SINGLE CYLINDER FUEL INJECTION EQUIPMENT AND PUMPSETS WITH SUCH OIL ENGINES**

Year	No. of O.E. of less than 100 B.H.P. exported	No. of O.E. of less than the 15 B.H.P. exported	Exports of O.E. spares in terms of unit of O.E.	Exports of O.E. Pump-sets	Total (a) (2+4+5)	Total (b) (3+4+5)
1	2	3	4	5	6	7
1966-67	3,489	2,921	600	N.A.	4,089	3,521
1967-68	2,135	1,829	2,000	112	4,247	3,941
1968-69	5,213	4,652	2,500	N.A.	7,713	7,152
1969-70	6,026	4,628	3,600	487	10,113	8,715
1970-71	5,491	4,087	6,000	1,180	12,671	11,267
1971-72	8,135	6,249	6,500	639	15,274	13,388
1972-76	12,730	6,467	12,000	1,319	26,049	19,786
1973-74	19,134	17,049	15,000	2,505	36,505	34,554
1974-75	39,361	34,402	25,000	6,550	60,911	65,952
1975-76	41,470	35,242	26,000	4,285	71,755	65,527
1976-77	39,395	31,886	28,000	20,065	87,460	79,951
1977-78	37,423	33,761	30,000	18,743	86,166	82,504

*Note:* O.E. : Oil engines

*Source :* Monthly Statistics on Foreign Trade of India, Volumes of respective years.

TABLE 3.4 : TOTAL NUMBER OF OIL ENGINES WITH PUMPSETS USED FOR AGRICULTURAL PURPOSES IN INDIA, AS PER THE LIVESTOCK CENSUS

(figures in '000s)

State	No. of oil engines with pumpsets			
	1966 April		1972 April	
	For irrigation	For irrigation	For other uses	Total
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	47	111	6	117
Assam	N	N	N	N
Bihar	4	42	7	49
Gujarat	112	366	5	371
Haryana	4	50	2	52
Himachal Pradesh	N	N	N	N
Jammu and Kashmir	N	N	N	N
Karnataka*	25	40	3	43
Kerala	7	18	1	19
Madhya Pradesh	17	53	11	64
Maharashtra	147	172	2	174
Manipur	N	N	N	N
Meghalaya	N	N	N	N
Nagaland	N	N	N	N
Orissa	1	6	N	6
Punjab	26	247	3	250
Rajasthan	7	36	1	37
Tamil Nadu*	43	207	27	234
Tripura	N	N	N	N
Uttar Pradesh	28	203	3	206
West Bengal	4	5	N	5
<b>All India**</b>	<b>471</b>	<b>1557</b>	<b>71</b>	<b>1628</b>

\*The data in Cols. 3, 4 and 5 relate to November 1972 for Karnataka and March 1974 for Tamil Nadu.

\*\*The All-India figures for 1972 April in Cols. 3 and 5 include 11 thousand units for which details are not available.

N = Nil or Negligible.

Source : Indian Livestock Census, 1972, Vol. I Summary Tables

**TABLE 3.5 : ESTIMATED NUMBER OF DIESEL ENGINE PUMPSETS SOLD IN DIFFERENT STATES IN INDIA IN 1977-78.**

(Number in '000s)

State	No. of Diesel Pumpsets
1	2
Andhra Pradesh .. ..	20
Assam and North Eastern States .. ..	4
Bihar .. ..	25
Gujarat .. ..	8
Haryana .. ..	8
Karnataka .. ..	6
Kerala .. ..	3
Madhya Pradesh .. ..	25
Maharashtra .. ..	15
Orissa .. ..	4
Punjab .. ..	8
Rajasthan .. ..	25
Tamil Nadu .. ..	8
Uttar Pradesh .. ..	60
West Bengal .. ..	12
Others .. ..	5
<b>Total .. ..</b>	<b>236</b>

**TABLE 3.6 : STATEWISE SALE OF DIESEL ENGINES FOR AGRICULTURAL PUMPSETS IN 1977-78 AS ESTIMATED BY KIRLOSKAR OIL ENGINES, LTD.**

(Number in '000s)

State	No. of Diesel Engines
1	2
Andhra Pradesh .. ..	16
Assam and North Eastern States .. ..	3
Bihar .. ..	26
Gujarat .. ..	5
Haryana .. ..	6
Karnataka .. ..	8
Kerala .. ..	1
Madhya Pradesh .. ..	28
Maharashtra .. ..	14
Orissa .. ..	2
Punjab, Himachal Pradesh, Jammu & Kashmir .. ..	8
Rajasthan .. ..	20
Tamil Nadu .. ..	6
Uttar Pradesh .. ..	70
West Bengal .. ..	10
<b>Total .. ..</b>	<b>223</b>

## CHAPTER IV

### DEMAND FOR REPLACEMENT OF OLD PUMPSETS AND TOTAL DEMAND

4.1 In addition to the demand for pumpsets — diesel or electric — for putting on existing dugwells and on points on streams, and demand for them on new dugwells or tubewells to be sunk in the coming years, a third source of demand is expected to be for renewal or replacement of old/wornout pumpsets. In order to estimate the demand for pumpsets from this source, it is necessary to have some idea of the number of years at the end of which an electric/diesel pumpset, despite routine repair and maintenance, will have to be replaced.

4.2 The life of a pumpset will depend, among other things, on the amount of work it is required to do on an average during a year. The financing institutions in the country, particularly the co-operatives have, for many years now, considered 7 years to be the life of a pumpset for the purpose of estimating the period over which the loan given for the purpose may be recovered. We were given to understand that one of the factors that led to this particular estimation of the life of an irrigation pumpset in years is the number of hours in a year for which it is considered most economical to operate a pumpset. This sets the norm for the work of a pumpset during a year. The technicians estimate the life in terms of the total number of hours for which a pumpset can be expected to work. This technical life in hours compared with the above norm of work, gives the life of a pumpset in years. This way of working out the life of a pumpset, however, does not take into account the number of hours for which the engines/pumps are actually used and the experience of the farmers regarding the life of the asset. In order to estimate the demand for replacement of engine/pump by farmers in years to come, the normative standard is less relevant than the actual experience of farmers. There is a general impression that pumpsets last much longer than 7 years. But no firm empirical evidence was available to the Committee to estimate the number of years after which, given the pattern of use, an engine/pump may stand in need of replacement. Therefore, at the request of the Committee a quick survey for the purpose was conducted by the officers of the ARDC under the overall supervision and guidance of the Member Secretary.

4.3 The main purpose of the enquiry was to obtain information from farmers, who had installed pumpsets for irrigation at least 10-12 years ago, about the lapse of time after which they had replaced their pumpsets, or were expecting to replace them. For this purpose, it was decided to select from the six states with the largest number of pumpsets in 1966, a district each with again the largest number of pumpsets. From each district, 30 farmers with pumpsets were selected from villages in which the State Land Development Banks had advanced the maximum number of loans for pumpsets in 1966. Besides, 10 additional farmers who had financed purchase of their pumpsets from their own funds were also selected from the same villages for investigation.

4.4 The survey showed that 239 surveyed farm households had acquired before 1967, 121 diesel pumpsets and 115 electric pumpsets (Tables 4.1 and 4.2). Out of the 121 diesel pumpsets which the farmers had in 1967, 33 were replaced in later years with electric motors when the villages concerned were provided with electricity. Of the 33 diesel pumpsets that were taken out, 3 were still with the owners at the time of the survey

(Dec. 1978), being used as standby units. The remaining 30 units had been sold away. 84 out of 88 units which were not substituted by electric motors were still in use on the farms. Only four were replaced by new diesel pumpsets, three because the original engines turned defective, and the fourth because an engine with a higher H.P. was required for work. Therefore, 84 of the 88 diesel pumpsets had been in service for more than 11 years. The owners expected these engines, with routine repair and maintenance, to render service for another six years on an average, unless they get substituted by electric motors when electricity comes to the village. It is noteworthy that there were only 3 instances of replacement of the diesel pumpsets due to defective working and 2 of these were after 13 years of service.

4.5 Some of the 239 surveyed farmers had more than one engine at the time of survey and most of these additional engines had been acquired by them after 1967. There were 40 such diesel pumpsets with the sample farmers in December 1978 and naturally they had been used for lesser number of years on an average than the earlier set. Enquiry with the farmers about the life expectancy of these 40 diesel pumpsets also showed that the farmers expected them to last 18 years on an average.

4.6 Thus the actual experience of farmers surveyed in the 6 different districts of India with a heavy concentration of diesel pumpsets showed that all the older pumpsets had worked for more than 12 years and the engines were expected to be in service for another 6 to 8 years on an average.

4.7 Turning to electric pumpsets, the survey showed that of the 115 electric pumpsets owned by the farmers at the end of 1967, only four were replaced subsequently; three by electric pumpsets and one by a diesel pumpset. The replacement of the 3 electric pumpsets by new ones were necessitated by defective working in 2 cases and the need for higher H.P. in one case. The reason for replacing one electric pumpset by a diesel pumpset was said to be on account of the high compulsory minimum charge fixed by the State Electricity Board and the inability of the farmer to make sufficient use of the motor due to poor availability of water in his well. One of the four farmers retained his old electric pumpset as a standby while the remaining 3 sold their old pumpsets.

4.8 The average life of the 115 electric motors acquired prior to December 1967 was thus nearabout 13 years. The farmers expected these to be in use for another 8 to 9 years on an average, i.e., they expected the working life of their pumpsets with electric motors to be about 20 years.

4.9 The farmers acquired 104 electric pumpsets after December 1967, either as additional units or as replacement for diesel engines/electric motors. But the farmers with these newer electric motors and pumps expected the units to last at least 18 years in all and no electric motor or pump had been replaced so far. The only major repair reported was the rewinding of the coil in the electric motors.

4.10 The life expectancy of the diesel/electric pumpsets in use in different parts of India would be different depending on the intensity of their use. In fact, there was difference among the surveyed districts both with regard to the number of hours per year for which the pumpsets were worked and the life expectancy of the engines/motors. Only in Coimbatore district of Tamil Nadu, where the average number of hours a pumpset worked was 700 hours, did the cultivators estimate the life expectancy of all the diesel



engines in use to be about 17 years. In all the other five districts surveyed where the average number of hours the pumpsets worked ranged between 270 and 890 hours, it was more than 18 years. Similarly, in regard to electric motors, only in Meerut District in Uttar Pradesh did the farmers estimate the life expectancy to be about 14 years (1550 hours a year on an average) ; in all the other districts surveyed it was more than 18 years (average number of hours of use between 470 and 1110 hours a year).

4.11 Farmers were also requested to estimate separately the life expectancy of the oil engines/electric motors and the pumps. The pumps were usually expected to last longer than the engines/motors driving them. The life expectancy of the pumpsets discussed above relate to the life expectancy of engines/motors, the comparatively less durable of the two components of the pumpset.

4.12 It is evident that, based on the actual use pattern of pumpsets and experience with them, there is no reason to expect a demand for renewal of a diesel or electric pumpset in less than 17 to 18 years from the date of its commissioning in almost all regions of the country. Thus, a diesel or electric pumpset, commissioned before the end of 1966 may be reasonably expected to be due for replacement by 1983. On this basis, one may expect all diesel and electric pumpsets commissioned before 1966 to be replaced by 1983.

4.13 However, this cannot be said of all the diesel pumpsets which had been commissioned by 1966. For, diesel engines have been replaced by electric motors following electrification of the village long before the expiry of their normal life-span. Information is not available on the number of villages with diesel engine pumpsets in 1966 which were subsequently electrified. But it is well known that it has been the practice of the Electricity Boards to extend, as far as possible, electricity first to such villages which have irrigation pumps, etc., or potentiality for them. Therefore, it may not be very unreasonable to assume that most of the diesel pumpsets of 1966 or earlier date have either already been replaced by electrical units or will be by the end of March 1983 (the end of the current Plan period). We may, therefore, estimate the replacement demand of old/worn out diesel pumpsets by new diesel pumpsets to be negligible.

4.14 The only relevant replacement demand will be that of electrical pumpsets. According to the information available with the State Electricity Boards, there were 5.13 lakh tubewells/pumpsets energised in India at the end of March 1966. All these, we may estimate, would be replaced by March 1983. Out of these 5.13 lakh units, 1.94 lakh units were already in existence by March 1961. It would be fair to assume that most of these would have been replaced by March 1978. Therefore, we may expect the total replacement demand for electric pumpsets during the period 1978-83 to be no more than 3.2 lakh units, if we assume a 17 year period for replacement demand. Actually, the average life expectancy of electric pumpsets was seen to be about 19 years in our survey, particularly for the older electric pumpsets. Therefore, we may make a liberal estimate of the replacement demand for electric pumpsets in India to be about 3 lakh units during the period 1978-83. Table 4.3 gives, state-wise, the total number of electrically operated pumpsets that were installed during the period April 1961 to March 1966. This indicates the approximate number of electric pumpsets which may require replacement in the different states during 1978-83.

### Estimated Total Demand for Pumpsets

4.15 We may now sum up the estimates of demand in Chapters II, III, and IV. The expected total demand for diesel and electric pumpsets during 1978-83 comes to 30 lakh units, consisting of 12 lakh diesel pumpsets and 18 lakh electric pumpsets. The 18 lakh electric pumpsets include 15 lakh units to be newly installed and as replacements for diesel pumpsets, and 3 lakh units to be replacement of worn out electric pumpsets.

4.16 These estimates are somewhat lower than the estimates made by the Planning Commission almost two years ago. The Commission had then estimated a total demand for 35 lakh units, of which 20 lakh were to be electric and 15 lakh diesel pumpsets. Our estimate is 5 lakhs short of the Commission's estimate. We may also draw attention to another point of relevance. In our estimate, the three lakh units, estimated to replace old electric pumpsets, will not create any additional irrigation potential. It may be thought that the same should hold for the electric pumpsets which will substitute diesel pumpsets, if one assumes that the diesel pumpsets taken out will mostly be used as standbys. But our investigations indicate that hardly 5 to 10 per cent of these diesel engines are likely to be kept as standbys; the rest will be sold to others, mostly farmers, who will use them for irrigation. Therefore, it would be fair to assume on the basis of the calculations made here, that 27 lakh of the 30 lakh diesel and electric pumpsets will provide net addition to the irrigated area during the current Plan period.

TABLE 4.1 : AVERAGE LIFE AND LIFE EXPECTANCY OF DIESEL PUMPSETS WITH THE SAMPLE FARMERS IN THE SIX SURVEYED DISTRICTS

District (State)	Total Number of diesel engines at the end of Dec. 67	Of which		Average actual life of the diesel engines in Col.(4) (Yrs. Mths.)	Number of diesel engines acquired after Dec. 67	Total Number of diesel engines in use in Dec. 78	Life Expectancy		
		Number replaced by electric engines before Dec. 78	Number of diesel engines still in use				Number reporting	Average (Yrs. Mths)	Range (Yrs.)
1	2	3	4	5	6	7	8	9	10
Chittoor .. (Andhra Pradesh)	20	5	15	12—7	2@	18	17	17—10	14—25
Rajkot (Gujarat)	33	3	30	14—6	12	42	42	18—5	15—25
Nasik .. (Maharashtra)	14	7	7	13—2	5	12	10	18—5	14—23
Ludhiana (Punjab)	25	9	16	13—11	8	24	12	20—11	15—24
Coimbatore .. (Tamil Nadu)	11	9	2	11—9	5	7	7	16—11	16—18
Meerut .. (Uttar Pradesh)	18	—	18	11—6	8	26	17	18—10	12—23
<b>Total</b> ..	<b>121</b>	<b>33</b>	<b>88*</b>	<b>13—4</b>	<b>40</b>	<b>129</b>	<b>105</b>	<b>18—7</b>	<b>12—25</b>

\* These 88 include 4 Diesel Engines used as standby. @ Purchase of a second-hand engine by one farmer is excluded.

TABLE 4.2 : AVERAGE LIFE AND LIFE EXPECTANCY OF ELECTRIC PUMPSETS WITH THE SAMPLE FARMERS IN THE SIX SURVEYED DISTRICTS

District (State)	Total Number of Electric Motors at the end of Dec. 1967	Of which		Average actual life of the Electric Motors in Col. (4) (Yrs. Mths)	Number of Electric Motors added after Dec. 1967	Total Number of Electric Motors in use in Dec. 1978	Life Expectancy		
		Number replaced before Dec. 1978	Number of Electric Motors still in use				Number reporting	Average (Yrs.Mths.)	Range (Yrs.)
1	2	3	4	5	6	7	8	9	10
Chittoor .. (Andhra Pradesh)	26	1	25	12—2	15	40	40	17—11	14—25
Rajkot .. (Gujarat)	3	1	2	12—0	3	5	5	20—0	15—25
Nasik .. (Maharashtra)	29	1	28	12—4	33	61	56	21—7	15—27
Ludhiana .. (Punjab)	8	—	8	12—0	30	38	13	18—1	14—23
Coimbatore .. (Tamil Nadu)	37	1	36	15—10	18	54	51	20—2	15—27
Meerut .. (Uttar Pradesh)	12	—	12	11—9	6	18	12	13—10	12—21
<b>Total</b> .. ..	<b>115</b>	<b>4</b>	<b>111</b>	<b>12—9</b>	<b>105</b>	<b>216</b>	<b>177</b>	<b>19—6</b>	<b>12—27</b>

TABLE 4.3 : REPLACEMENT DEMAND FOR ELECTRIC PUMPSETS

(Number in '000s)

Name of State	Replacement demand*
1. Andhra Pradesh	39.3
2. Assam	—
3. Bihar	7.5
4. Gujarat	10.2
5. Haryana	11.7
6. Himachal Pradesh	0.1
7. Jammu & Kashmir	—
8. Karnataka	25.5
9. Kerala	4.3
10. Madhya Pradesh	5.5
11. Maharashtra	37.8
12. Manipur	—
13. Meghalaya	—
14. Nagaland	—
15. Orissa	—
16. Punjab	16.8
17. Rajasthan	5.8
18. Sikkim	—
19. Tamil Nadu	138.9
20. Tripura	—
21. Uttar Pradesh	7.5
22. West Bengal	0.4
23. Union Territories	2.7
<b>Total :</b> .. ..	<b>314.0</b>

\* These give the total number of new electric pumpsets installed during the years 1961-62 to 1965-66.  
Source : Rural Electrification Corporation.

## CHAPTER V

### REPAIR AND MAINTENANCE FACILITIES

5.1 The Committee has been required to enquire into the repair and maintenance facilities available to the farmers using diesel or electric pumpsets for irrigation. It is generally known that the farmer is entitled to free service during the warranty period from the dealer. However, very little was known about the actual experience of farmers in this regard. Information about the routine repair and maintenance service available to the farmers in different parts of the country was also inadequate. It was, therefore, decided to collect from the selected farmers in the six districts, in which the survey referred to in Chapter IV was carried out, information about the quality of service facility provided by the dealers during the warranty period, the nature and frequency of repairs required, agencies providing such service and the farmers' opinion about it. It is, however, necessary to note that the survey was carried out in six districts which were having extensive lift irrigation facilities for many years. Naturally, the repair and maintenance facilities are likely to be much better in such areas than in regions where power-driven water lifts for irrigation are a relatively recent phenomenon. For such regions, the Committee has depended mainly on the reports prepared by the technical consultants appointed by the ARDC.

5.2 The survey shows that the respondent farmers were, by and large, satisfied with the service provided by the dealers except in two districts, Ludhiana and Meerut, where some of the cultivators complained of lack of any service facility from the dealers. The ARDC consultant's report for Uttar Pradesh also refers to the unsatisfactory "after sales" service, and calls for a proper code of practice for the dealers. In the Eastern States like Bihar, Orissa and West Bengal, the situation is still less satisfactory, partly because of the sparsely located pumpsets and the distance of the location of dealers from the villages.

5.3 Routine repair and maintenance service in the different regions is provided by individual technicians. These range from mechanics and electricians with no formal training but with at least 4 to 5 years experience in the type of work, to people with formal training as technicians and some minimum work experience. During the field investigation in the six districts, 18 such servicemen were interviewed. Only 7 of them were operating individually, with or without a workshop; the remaining 11 had workshops with employees working under them. All of them not only attended to repair work in their shops, but also visited the villages to attend to calls from farmers. Some of them had entered into contracts with farmers for routine maintenance and repairs, and made regular visits to the farms for the purpose, for a fixed annual fee. Many of them kept stocks of spare parts with them. They were located mostly in taluka towns or market centres and generally operated within a radius of 15 kilometers.

5.4 The 239 cultivators surveyed in the six districts generally expressed satisfaction at the repair and maintenance facilities available to them for their diesel and electric pumpsets. Nearly 43 per cent of them had required no major repairs since they purchased the pumpsets. Another one-third of the farmers had such major repairs done only once or twice. Only 16 per cent of the farmers had more than 2 major repairs in more than 12 years. In the case of diesel engines, the most common item of major repair

reported was the replacement of the liner piston, followed by other items like repair or replacement of crank shaft, impeller, nozzle, filament, bush, ball bearings and couplings. Most of these, in any case, were a periodic necessity. In the case of electric motors, the major repair was rewinding of the coils, which arose partly because of bad handling of the equipment, sometimes absence of starters, and partly due to high fluctuation in the voltage of electricity. All these were attended to by the mechanics or professional repairmen.

5.5 Most of the respondents also got their minor repair works attended to by these mechanics, etc. In the case of electric motors, everybody engaged electricians for minor repairs. Some farmers, however, themselves attended to the minor repairs of the oil engines, partly because the repairmen were located rather far off, and partly because the farmers were able to handle the minor jobs themselves.

5.6 Thus, in areas where the use of irrigation pumpsets was widespread, a sizeable number of repair and maintenance service personnel and workshops had developed to cater to the needs of the farmers. Consequently, the farmers were generally satisfied with the facilities available. But this cannot be taken to imply that these services were always upto the mark. The technical consultants to the ARDC have reported for Andhra Pradesh and Uttar Pradesh that the repair and maintenance service available was not satisfactory and anything like 20 to 25 per cent of the sample of engines examined by them suffered from poor maintenance and, consequently, reduced efficiency. The farmers are not always in a position to notice this. Of course, a part of the blame for this lies with the farmers, who in order to avoid extra expense, do not get their engines serviced at regular intervals. But partly the responsibility lies with the repairmen.

5.7 In the areas in which irrigation pumpsets are relatively less numerous, the private repair and maintenance service takes time to come up. In the Eastern States of Bihar, West Bengal and Orissa, the consultants to the ARDC have reported that the level of repair and maintenance service was found to be extremely poor in terms of both quality and frequency. They refer to instances where the mechanics have made alterations, ostensibly to help in starting the engine, that have actually resulted in reduced thermal efficiency and caused wear and tear.

5.8 In the normal course, the growth of repair and service facilities is found to follow the growth in the number of irrigation pumpsets in an area and not precede it. However, it is necessary to make special efforts to see that such service becomes simultaneously available in areas where introduction of pumpsets is relatively new but holds considerable potentiality. Lack of proper service facilities might work as a damper on the enthusiasm of the farmers for pumpsets.

5.9 The Committee, therefore, is of the view that efforts should be made by different agencies in the field to promote suitable repair and maintenance personnel/agencies, particularly in areas where lift irrigation is comparatively new. The manufacturers of engines and pumps or their dealers doing business in the area should pick up and train private mechanics and other qualified technicians to attend to various problems of the diesel/electric pumpsets. Such training will not only provide a useful and competent service to the farmers, but will help the manufacturers in better maintenance of the machines sold by them. The training should be given, if necessary, by the manufacturer or his dealer bearing the cost of such training for 2/3 months. Similarly, the financing

agencies operating in the area, like the commercial banks, the LDBs and the CCBs, may pool their resources and help in training at least a few local mechanics and technicians in this business. They may also bring these trained repairmen to the attention of their clients with pumpsets. The commercial banks can, in addition, provide, if necessary, loans to such trained personnel towards capital investment for a small workshop and quick transport facility. The newly created District Industrial Centres can also lend a helping hand in this direction. A coordinated effort by these different agencies at the Taluka or Block level would help overcome the deficiency in the repair and maintenance service, particularly in areas with inadequate facilities, and avoid inconvenience and loss to the farmers and consequent discouragement to other potential irrigators.

5.10 Besides the poor repair and maintenance facilities in many areas, the consultants to the ARDC have drawn attention to the failure of farmers to get their engines/motors serviced at regular intervals. It is necessary to bring this to the attention of the farmers. The agricultural extension agency at the village level may be required to advise the farmers regularly on this matter. The training of the village level workers who are to be posted in areas of lift irrigation, should include introduction to problems of installation, repair and maintenance of diesel and electric pumpsets. The financing agencies also may advise farmers to enter into arrangements with trained service men or agencies who will undertake to provide regular maintenance and servicing of the equipment.

5.11 The inefficiency and trouble in the operation of diesel as well as electric pumpsets, noticed by the consultants to the ARDC, have been attributed mostly to the defective choice of equipment by the farmers and faulty installation. We propose to turn to this important question in the next Chapter where we shall discuss the current policies and procedures for financing investment in pumpsets.

## CHAPTER VI

### POLICY AND PROCEDURE FOR LOANS AND REPAYMENTS

6.1 The Committee has been required to examine the present loan policy and procedure and the repayment system adopted by financing institutions and suggest rationalisation thereof, if needed, based on the economic life of pumps as well as the additional income generated by such investments for small, medium and large farmers. We propose to make a brief review of the current practice as it has evolved during the last decade and make some suggestions in the light of the facts that have come to our attention.

6.2 Loans for purchase of pumpsets or for the combined purpose of sinking a well or tubewell and putting up a pumpset, are advanced in the country from three main sources: the Land Development Banks, the State and Central Co-operative Banks, and the Commercial Banks. Besides these financing agencies, the State Governments have, from time to time, directly provided loans for installation of pumpsets by farmers or groups of them. Occasionally, private voluntary agencies working in rural areas manage to collect funds and advance them to farmers for this and other investment purposes. This of course accounts for an insignificant portion of the total loan funds made available for the purpose. There is very little other non-institutional credit available or used for the purpose. The Land Development Banks have been earliest in this field and account for the major part of the total institutional loans for pumpsets. The State and Central Co-operative Banks, which provide mainly crop loans to farmers, have also always financed purchase of pumpsets as medium term loans. The Commercial Banks, which entered the field of agricultural credit about a decade ago, have over the years been taking an increasing share of the total loans for the purpose. During the years 1976-78, they provided nearly 25 per cent of the total institutional credit for the purpose, the remaining coming from the various co-operative institutions.

6.3 The Reserve Bank of India has, from time to time, laid down guidelines for the co-operative financing institutions, about the conditions of financing. The considerations underlying the guidelines laid down and practices followed are broadly as follows: (1) The loan funds should be made available to potentially productive borrowers, i.e., those who need it and can use it and service the loan, (2) The loan fund should not lie unrepaid with the borrower longer than is necessary, (3) The loan fund is used for the purpose for which it is given, and is not diverted to other uses and (4) The farmer invests the funds in equipments appropriate to his requirements, and is not overcharged by the sellers.

6.4 In so far as the eligibility of a farmer or group of farmers for a pumpset is concerned the guideline from the Reserve Bank, laid down since May 1969, says that the loan should be determined with regard to the estimated cost of development, and not related to the value of hypothecation which can be provided by the farmer. The farmer is to be considered eligible for loan for a pumpset, if with the help of the pumpset he can be expected to generate an adequate extra income which, after meeting a reasonable increase in his family living expenditure, can leave an adequate surplus from which the farmer can repay the loan in appropriate instalments. This procedure is now generally

followed by not only the co-operative financing institutions but also by commercial banks. The older practice of determining eligibility for loan on the basis of the mortgage/hypothecation of real estate or other assets by the farmer, has now been abandoned.

6.5 After a few years' experience with this guideline the RBI reviewed the position and found that this guideline had not always been properly interpreted. Consequently, financing institutions had sometimes advanced loans for pumpsets to parties who did not have a reasonable area of land in a block around their wells or tubewells. The result was the equipment was grossly under-utilised, creating subsequent problems at the time of repayment of loans. The RBI, therefore, laid down a supplementary guideline in 1971 by which the banks were advised that loans for pumpsets may generally not be given to borrowers with less than a compact area of 3 acres near the well or the tubewell. That, we understand, is the present position.

6.6 This second guideline would not have been necessary if the original guideline had been properly followed by the financing agencies and their concerned field staff. For, if a farmer does not have enough land under his cultivation around the source of the irrigation, then obviously he cannot generate adequate extra income with which he can service the loan. The compact 3-acre lower limit suggested in the supplementary guideline is essentially in the nature of a rule of thumb. As long as it is interpreted not as a rigid rule but only as a reminder that this aspect has to be carefully examined, the guideline can do only good and no harm. But unfortunately, in all these matters there is often a tendency to interpret such indicative guidelines as definitive permissions or prohibitions. Under such circumstances, there is a danger that genuine and economically viable cases may be precluded. To give only one example, in recent years, some small diesel engines of only 1.5 H.P. are being produced and widely marketed in the paddy growing areas of West Bengal, coastal Orissa and Kerala. These engines are light enough to be carried by the farmer from field to field. The natural water courses, pools, and small tanks near the rice fields in these regions provide suitable sources for irrigating the nearby paddy fields. These small diesel engines are consequently supplanting the hand operated water lifting devices in these regions. The point of interest for us here is that for such a diesel engine it is not necessary that a farmer has at least 3-acres in a compact block; it is only necessary that his fields, however scattered, are within the reach of the sources of water from which these small engines can lift water to the fields. A rather rigid interpretation of the Reserve Bank's guideline can result in denial of loans to farmers for purchase of these small diesel pumpsets, even when otherwise they can qualify for it. The Committee, therefore, is of the view that the RBI may be requested to modify or clarify its directive in such a manner that deserving farmers are not deprived of the benefit of loans for not having at least 3 acres in a compact block.

6.7 A second guideline from the Reserve Bank relates to the length of the period over which the borrowers may be allowed to spread their repayments. In 1971, the RBI advised the Land Development and Co-operative Banks that loans for only pumps operated by electric motors or diesel engines should ordinarily be for only 7 years. In the case of composite loans for wells and pumpsets, the repayment period for the pumpset part is only 7 years for all types of farmers. Until this guideline was provided, the co-operative institutions had a longer permissible period. The exact reason for this revision is not clear. However, as we noted earlier in para. 4.2, Chapter IV, an important ground for this 7-year period appears to be the useful or economical life of a pumpset based on a "norm" of working hours for a pumpset in a year. A rigid implementation of this



guideline is likely to lead to rejection of loan applications in situations where the request may otherwise be justifiable on economic grounds. We explain the point below.

6.8 As we noted earlier, the guideline relating to the eligibility of a farmer for a loan for a pumpset (for a well with pumpset) requires that the economic returns from this investment to the farmer should, subject to the upper limit of the life of the investment, form the basis for deciding whether the farmer is creditworthy in this respect. If it is estimated that the incremental income due to the investment can leave a surplus adequate to service the loan after meeting any reasonable increase in family living expenditure, then the loan can be sanctioned. The period over which the repayment of the loan may be scheduled would then depend on this estimated surplus. It is possible that in the case of some farmers making this type of investment, the surplus may be large enough to enable repayment of the loan with interest within 4 or 5 years. Under such circumstance, we would expect the financing agency to schedule repayment accordingly. The 7-year limit will not create any problem in this case. However, there may be other farmers, particularly small farmers, in whose case the surplus out of the incremental income due to the investment, after meeting reasonable increase in family expenditure, may not be thought to be adequate to repay the loan within 7 years. In such cases, the bank under the present guideline is likely to reject the application. However, if in such cases the repayment period can be extended beyond the 7 year limit, then the farmer may be in a position to repay the loan from his estimated surplus.

6.9 We noted in Chapter IV that on the ground of actual experience, farmers have generally used their diesel or electric pumpsets for 12 years at a stretch, and expect to do so for at least another 5-6 years before it may become necessary to replace the equipment. This, in our view, suggests that where necessary, the repayment period may be extended beyond the 7-year limit, without risking the repayment of the loan on the ground of expiry of the working life of the pumpset.

6.10 It may be argued that a pumpset may continue to be in use for longer period if it is not being economically used. Our survey showed that on an average, the pumpsets were being used for about 800 hours a year (Tables 6.1 and 6.2). The cultivators' estimate of the total number of years they expected their pumpsets to work, implied a life of about 14 to 15 thousand working hours for the pumpset. This is also in general agreement with the technicians' estimate of the working life of a pumpset. Therefore, a longer estimated life in years than the 7-year limit implies a lower number of hours for which the pumpset is being worked in a year than is considered "economic". It is possible that some pumpsets with this working life are not being used economically. But, as noted earlier, the economic nature of the investment has to be determined by estimating the incremental net income due to the investment, and the surplus that it may leave for repayment of the loan. By that test, farmers likely to use pumpsets for lesser number of hours than implicit in the 7-year limit may also turn out to be economic and, therefore, cannot be denied loans.

6.11 Our recommendation to relax the current 7-year limit for repayment of loan for pumpset, however, does not mean that in our view, all loans for pumpsets should have longer repayment period. Indeed, as we stated earlier, there will be cases, particularly of large and even medium farmers, where the available surplus net incremental income, after meeting normal increases in family expenditure, may turn out to be large enough to enable repayment even within, say, 5 years. In such cases, the repayment schedule

should be worked out for 5 years. But where the estimated surplus income appears adequate for repayment, only if the repayment period is extended beyond the 7-year limit, we recommend that such extension should not stand in the way of sanction of the loan. Nor should this recommendation of the Committee be construed to mean that we suggest extension of the limit from the present 7 to 17 years — the expected life of the pumpsets estimated by us in Chapter IV. It is true that repayments cannot be scheduled beyond the life of the asset. But we do not anticipate that in most cases requiring a longer period of repayment, it would be necessary to extend it beyond 10 or 12 years.

6.12 Besides the small farmers and such others, extension of the repayment period may be necessary under another but not wholly unconnected circumstance. In the case of a composite loan for a tubewell or dugwell with pumpset, the estimated incremental income at the time of the sanction of the loan, may not materialise, if, unfortunately the water supply in the well or tubewell turns out to be inadequate for the purpose. Here we are not referring to what are clearly "failed wells", that is, wells with very little or no water or wells with water unfit for irrigation. We are referring to situations where the water supply in the well turns out to be less than anticipated. In such situations the crop pattern envisaged at the time of appraisal may not materialise to the full extent and the anticipated incremental income may not accrue to the farmer. The farmer may not, therefore, be able to adhere to the repayment schedule worked out at the time of granting the loan. Instead of calling such a borrower a defaulter and taking prescribed action, it is necessary to work out a new repayment schedule in his case. This would imply a longer repayment period than anticipated and possibly longer than the present 7-year limit. We recommend that this extension should be considered legitimate, and the repayment schedule should be worked out afresh as a matter of course after due technical clearance to facilitate his servicing of the loan.

6.13 The next basic consideration underlying the Reserve Bank's guidelines for loan operation of the financing institutions, to which we now turn, is that the loan should be used for the purpose for which it is given, and is not diverted to other uses. In order to ensure that the borrower uses the loan for the specific purpose, the Reserve Bank, in 1969, advised the banks not to make cash payment to the borrower, but to make the payment directly to the dealer who sells the pumpset to the borrower on the basis of his invoice. The banks were further advised to take special care to scrutinise the invoices given by the suppliers, since they had sometimes been found to have included several items which had, in fact, not been supplied to the borrowers. There was also the risk of over-invoicing in order to divert funds. Therefore, the Reserve Bank advised the banks to maintain price lists from the approved manufacturers and suppliers and keep the lists under close and constant scrutiny so that any change may be readily taken note of.

6.14 Despite these guidelines, subsequent field studies by the RBI revealed a number of malpractices in regard to actual utilization of loans for purchase of pumpsets, oil engines and electric motors. Cases were noticed where firms or dealers had given full or partial cash payments to the borrowers instead of supplying the equipment shown on the invoice. In a number of instances it was noticed that the PLDBs had made payments to firms which were not in existence and/or whose proprietors were not traceable. There were yet other instances of total or partial misutilization of the loan amount.

6.15 As a result of these, the Reserve Bank issued a supplementary set of guidelines in April 1972 for adoption by Land Development Banks. These stipulated, among others, that (i) the land development bank should maintain an approved list of authorised dealers/manufacturers of oil engines, pumpsets, electric motors, etc., in its area of operation and obtain from them the prices of different types of oil engines, electric motors and pumpsets along with their maximum permissible retail prices; (ii) the borrower should be asked to bring the sale offer only from an authorised agent/dealer; (iii) before making payment, the bank should ensure that the supplying firm is an authorised agent of the manufacturers and is also known in the market for doing regular business; (iv) no loans should be granted for second hand pumpsets, diesel engines or electric motors; (v) the amount of loan sanctioned by the bank should be disbursed directly to the dealer after verifying the delivery of the equipment to the borrower and (vi) the bank should periodically verify the existence of the equipment on the farmer's field by deputing a supervisor for spot verification.

6.16 These guidelines are being followed by the LDBs and the co-operative banks during the last 6-7 years. But during the last year or so, the Reserve Bank has been receiving requests from some State Governments that the Land Development Banks might be permitted to disburse loans for purchase of electric motors and diesel engines directly to the borrowers in cash instead of making payments to the suppliers of the machinery. The reasons for such request appear to be quite a few. In the first place, there is a feeling that the Reserve Bank's guideline requiring the banks, on the one hand, to maintain a list of authorised dealers/manufacturers in their area who have regular price lists and who have a reputation in the market for doing regular business, and on the other, to entertain offer of sale to the borrower from only such dealers, has prevented many small manufacturers from being considered for the purpose of loan finance. Moreover, there has been complaints about dealers/manufacturers, who, while on the approved list of the financing institutions, have been very negligent in providing service even during the warranty period, have shown reluctance to replace defective equipment, or to do so in time, have failed to supply accessories for which payment had been made, and have conveyed a higher price to the banks than is sometimes prescribed by the State Governments.

6.17 The Reserve Bank, after enquiries in the field decided to meet the situation arising out of these circumstances, not by permitting direct payment of the loan amount in cash to the borrowers, as suggested, but by trying further to plug the loopholes wherever possible. The question of having a larger body of manufacturers in the approved list of the financing institutions has been examined at the all-India level, and we shall refer to the decisions arrived at subsequently in this chapter. The RBI is a party to those decisions. Besides that, the Reserve Bank has laid down some additional safeguards. It advised the banks to ensure that the dealers desirous of supplying pumpsets to borrowers be required to enter into an agreement with the LDBs providing for (i) an undertaking to supply pumpsets, engines and accessories at the rates notified from time to time by the State Governments; (ii) willingness to provide after-sale service as also to honour the guarantee in respect of the machinery supplied; (iii) replacing the sub-standard pumpsets and attending to defects within a period of 6 months; (iv) agreeing to receive 25 per cent of the cost of the pumpset and accessories after verification of utilization of instalments; and (v) an undertaking to refund the cost of accessories billed but not supplied.

6.18 The Committee is of the opinion that it would be inadvisable to give the loan amount directly to the borrower for purchase of pumpset when the bank is in a position to make this payment on his behalf to the dealer on receipt of the invoice. The Committee also endorses the guidelines laid down by the Reserve Bank referred to above. In the light of the experience in the field, these guidelines should not only improve the utilization of the loan for the purpose intended but also ensure better service and quality of equipment to the farmers. The Committee is of the view that the commercial banks also may consider and adopt these for their loan operations for pumpsets.

6.19 The real serious question that remains to be examined is the type and quality of engine/motor/pumpset, the purchase of which the financing institutions may finance. One of the considerations underlying the Reserve Bank's guidelines is to see that the farmer invests his funds in equipment appropriate to his requirements. The present guideline has resulted not only in different manufacturers and dealers featuring in the approved list of banks in different parts of a state, but even in different financing agencies in the same place having different lists. Moreover, as we noted above, there is a widespread feeling that mostly established large or medium scale manufacturers have featured in the list; the small scale producers, not to speak of the assemblers of pumpsets, do not find a place.

6.20 The question of the selection and distribution of pumpsets under various loan schemes was discussed in a meeting of the Government of India, the various State Governments and financing agencies and the Reserve Bank of India in July 1977. A set of recommendations emerged out of these discussions, which were subsequently endorsed by the Government of India, who have asked the State Governments to set up the necessary organisation. The RBI has also on its part requested the State Governments to do the needful in the matter. The final recommendations are summarised below :

1. In every State a Technical Committee under the Chairmanship of the Agricultural Production Commissioner and with the representative of the Central Government should prepare an approved list of pumping sets with due regard to (a) the ISI marking, (b) Quality marking, (c) past experience, (d) after-sale service, (e) price, (f) availability, (g) suitability in the hydro-geological conditions, etc. The list should be valid for all financing agencies in the State, who should not be allowed to maintain their own lists. The list should also indicate the price range, the ancillaries, if any, the names of the dealers and agents, etc. There should be a ceiling on the margin allowed to the supplier/dealer. The farmer will have the final choice of the brand from within the approved list, subject to suitability from technical angle.
2. The Technical Committee should meet at least once a year and review the approved list based on the reports received from the field.
3. The approved list should be for not only the engine or motor, but for the entire composite of pumping set including the pump and the coupling.
4. The suppliers and manufacturers outside the State should not be excluded from consideration.

5. The State Government should develop its own quality marking schemes for testing and certifying the pumping sets, in collaboration with the ISI.
6. The ISI should recognise the regional laboratories of the small scale industries wing of the Central Government and other laboratories of the universities and the State Governments, and get them equipped properly for the use of small scale manufacturers.
7. The small scale units should be given some financial help in getting their pumping sets certified and tested under the ISI scheme.
8. The ISI should standardise the components and design of the pumping sets. They should also formulate "code of practice for installation and after-sale service for pumping sets", similar to those prescribed for tractors.
9. The Agro-Industries Corporation should take on supply and after-sale service of approved brands of pumping sets especially in the small scale sector on an agency basis. The agro-service centres of the Corporation can render the after-sale service on a commission basis for which the manufacturers should pay some amount to the Corporation. In the backward States, the Agro-Industries Corporation should take over the supply of pumping sets to the farmers through institutional finance, on a 100 per cent basis. In other areas, where the supply is not through the Corporation, the West Bengal system of the banks keeping 5 per cent per pumping set as security for after-sale service and warranty, should be adopted. The banks should get the repairs and after-sale service done, in case of complaint, with the use of the security deposit.
10. The field staff of agriculture, extension and minor irrigation departments should continuously inspect the pumps and supply information about the performance of the pumping sets to the banks, Agro-Industries Corporation and the State Headquarters to ensure that repairs are done immediately and the manufacturers with unsatisfactory record of after-sale service or poor performance of pumps are taken out of the approved list. The small scale manufacturers who do not have after-sales service facility in certain districts could appoint the agro-service centres as their agents for such service on a commission basis.
11. Training facilities for the farmers and the extension workers for installation, maintenance and repair of the pumping sets, should be arranged.

6.21 The Committee is of the view that the procedure recommended above will not only ensure provision of a common list of approved suppliers/manufacturers in a State, but also help create a machinery at the state level where the small local manufacturers (and even assemblers, if they choose) can bring their product for quality certification. This should go a long way in not only meeting the requirement of providing possibility of selection of the products of small manufacturers, but also gradually lead to an improvement in the quality of the product all round. It is not as if all small producers are producers of poor quality. Indeed, the Committee checked on the fuel consumption of the diesel engines surveyed in the six districts. It was found that there

was no significant and systematic difference between the fuel consumption rate of those with ISI mark and those without (Table 6.3). Of course, this was a quick survey where the details of consumption of diesel oil and use of the engine during the year were given by the respondents from memory. Besides, the lack of difference in fuel consumption could partly be due to defective installation, inappropriate selection of equipment and mismatching of major parts of the pumpsets, and may therefore, not be able to say anything about the relative efficiency of ISI mark and non-ISI pumpsets. But the fact remains that pumps other than those currently with ISI mark may also be of satisfactory quality. The institutional set up suggested in the above recommendations would bring many of these within the approved list, and thereby enable bank finance to be used for purchase of such equipment as well. The Committee is given to understand that many State Governments have yet to take active steps in this direction. We would urge upon all concerned to take appropriate steps in this direction early, and help the small manufacturers as well as the farmers in the process.

6.22 While the inclusion or exclusion of different manufacturers in the approved list of the financing institutions has been one type of complaint, a different and, in our view, more serious type of complaint relates to the suitability and efficiency of different types of diesel and electric pumpsets actually installed. The ARDC had commissioned technical consultants to conduct enquiries in a number of States into the efficiency of the diesel and electric pumpsets operating there, and the reason for the low efficiency noticed. Their reports for the States of Andhra Pradesh, Uttar Pradesh, Bihar, West Bengal and Orissa were made available to the Committee. Besides, similar technical study is also available for Gujarat. The findings of these studies show that the widespread poor efficiency of the pumpsets in action was due mainly to improper selection of pumps/prime movers, poor or defective foot valves and poor installation of the equipment, both diesel and electric. Sometimes prime movers of lower or higher horse power than appropriate were used. Electric motors were installed without starters. Pumpsets were mismatched for the designed duty. There was little awareness regarding matching the pumpsets with the required discharge and the total head to which water was to be lifted. The selection of pipes, both on delivery and suction side, was not proper. Defects of installation were also many. Pumps were located at sites which were inappropriate from the point of view of efficient working. Foundations were not properly laid, in some instances engines had been mounted on wooden planks. Electric motors were not used with capacitors nor were single phase preventors fitted. The list can be lengthened. The basic conclusion from the findings of the Consultants' reports is that the major source of inefficiency in the working of diesel and electric pumps was the inappropriate choice of equipment and defective installation. This is a matter that has to be taken care of at the start of the investment, and cannot be left to later maintenance and repair work. A part of the trouble may be due to poor quality equipment, as, say, with foot valves; but another and a larger part is due to inappropriate choice of equipment for the task on hand. While the institutional set up to establish quality of the product at State level would take care of the first, the second aspect cannot be tackled by that mechanism.

6.23 The Committee finds that today the farmer rarely gets advice from any competent agency about the appropriate equipment for his site and work. Our survey shows that most farmers depended on themselves or their neighbours in making the choice. Very few consulted even the dealers. The same is the report of the Consultants to the ARDC. At the financing agency end, there is a provision for scrutinising the economic feasibility of the investments; but there is no provision to check and see if the equip-

ments for which the farmer is asking a loan are appropriate to his requirements. A verification of this may not only change the estimated investment, but ensure economical working of the pumpset thereby increasing the incremental income. The Committee is, therefore, of the opinion that all financing institutions should require the applicants for loans for pumpset to specify the details of the equipment needed, their estimated costs and the detailed costs of installation. The bank should then get these details checked by asking a qualified technical person to visit the proposed site of the investment and give specific recommendation on the technical requirements of the applicant. The economics of the investment should only then be worked out, and the loan sanctioned, if found satisfactory. The Bank can retain a full-time engineer in areas where there is enough work for one; otherwise, it can engage a qualified person as a consultant on commission. In any event, the Committee suggests that this technical scrutiny must be an integral part of the procedure for sanctioning a loan, and no loan should be granted without this technical clearance.

6.24 It is not enough that the loan is sanctioned after the bank has satisfied itself that the equipments to be purchased are what are appropriate. It is also necessary to see that these are actually installed. The farmer, of course, has the freedom to choose his supplier from the approved list. But the 25 per cent of the price of the equipment which the RBI to-day advises the banks to keep as a caution money from the dealer, should not be released until the bank is satisfied that all the technical details agreed upon have been executed. If these steps are taken by the financing institutions, we believe a large part of the defects pointed out by the Consultants can be avoided in the new installations.

6.25 There is another matter relating to the present financing procedure to which we would like to draw the attention of the commercial banks in particular. In working out the repayment sum every year, the various co-operative financing institutions calculate equated instalments, i.e., the borrower is required to pay a given sum every year including principal and interest. The principal component in the total increases every year till the last and the interest component decreases, while the total is the same every year. As against this practice, the commercial banks charge equal instalments of the principal every year plus the interest on the outstanding principal. This results in the farmer being required to pay a larger total sum in the beginning, with the annual total payment diminishing in subsequent years. We think this is rather unhelpful. For, it is well-known that farmers starting irrigation take time to bring their farm to the full irrigation potential. In a private lift well irrigation scheme a farmer may be expected to achieve the full irrigation potential at the end of 3 or 4 years. This implies that his incremental income from irrigation will be low in the initial years and reach the highest potential only at the end of, say, 4 or 5 years. Under such circumstances, it is not very helpful to require him to repay a larger sum in the beginning, and then smaller sums in subsequent years. We suggest that the commercial banks may adopt the method followed by the LDBs in this matter, for repayment of loans taken for pumpsets and/or for composite investments.

6.26 In the above paragraphs we have discussed not only how the loans taken for the purpose of pumpsets can be properly utilised, but also how financial institutions can ensure that the farmers buy the most relevant and useful set of equipment for the purpose. However, it is useful to remember that this effort can reach only those farmers who borrow from the financial institutions. It is our estimate that at

present only about 60 to 65 per cent of the farmers who invest in diesel engine or electric motor and pumpset during the year, borrow from the financing institutions; the rest finance their purchase from their own savings or from other sources. During 1976-77, the total number of diesel and electric pumpsets newly installed was about 4.0 lakhs. But the total number of units financed by the cooperative and Commercial banks estimated on the basis of the loans for the purpose disbursed by them during 1976-77 and 1977-78, respectively, came to about 2.5 lakhs (Table 6.4); inclusion of the composite loans may raise this figure to no more than 2.60 lakhs. That means, about 65 per cent of the units installed had been financed by the financing institutions. It is useful to remember that the financing institutions can have no control on the quality of the equipment purchased by the remaining one-third of the total investors.

6.27 We may finally attempt an estimation of the number of total pumpsets that the financing institutions may be expected to finance during 1978-83. We have estimated that during the 5 years, 1978-83, the total demand for pumpsets will come to 30 lakh units. On the basis of the recent experience of the financing agencies, referred to above, one may say that the financing institutions may be required to finance about 20 lakhs of these 30 lakh units.

6.28 What types of investors are likely to seek loan assistance? It is likely that most farmers putting up pumpsets for the first time will seek loans, as has been the experience so far. But even here, quite a number of farmers may not be able to get loans from the financing institutions. For example, it is estimated that near about 50 thousand diesel pumpsets a year are currently being sold by small assemblers all over the country. The buyers of these equipments and such others are likely to remain outside the scope of institutional finance. Secondly, most farmers who are likely to substitute their diesel engines with electric motors are unlikely to seek or get any bank loan for the purpose. The survey also shows that no farmer who had substituted his diesel engine with electric motor had financed it with loan from a bank. This practice is justifiable because the electric motors are less expensive than diesel engines of comparable horse power, and most of the diesel engines displaced are sold by farmers who thereby recover a part of the cost of the cheaper electric motor. For a farmer already irrigating some land with pumpset, it may not be very difficult to provide the balance from his own funds.

6.29 Finally, there is the question of replacement of old pumpsets. We have estimated that nearly 3 lakh electric pumpsets may stand in need of replacement during the current Plan period. Some diesel units under similar conditions may require replacement with new electric or diesel pumpsets. The Reserve Bank has not so far issued any guidelines to the banks in this matter. Our survey shows (Table 6.5) that 50 per cent of the pumpset-users said, they would not seek loan to finance their investment when the need for replacing the existing equipment arises. Most of the remaining half of the sample farmers stated that their income position was not so comfortable as to enable them to finance replacement from their own funds, that the sum required would be too large for their savings, or that they had too many other financial obligations to think of self-financing this investment. Many of them, particularly in Chittoor (Andhra Pradesh) and Rajkot (Gujarat) districts, were relatively smaller farmers with incomes that could not be considered high enough for self-financing of investment in renewal of pumpsets. The Committee would have liked to suggest to the RBI and the ARDC specific guidelines on the question of financing of replacement demand. However, considering the fact that such replacement demand may be about 3 lakh units



at the most during the current Plan, and the indication from our survey that not more than half of the concerned farmers are likely to seek loan for the purpose, we think it is not necessary at this stage to lay down any specific guidelines. It is of course presumed that while financing replacement, the value of the old pumpset which the farmer may recover by selling it, will be taken into account by the financing agencies.

6.30 We have estimated that out of the 30 lakh pumpsets likely to be demanded during 1978-83, 20 lakh units will have to be financed by the financing institutions. The estimated total loan finance requirement, at the rate of about five thousand rupees per pumpset, come to Rs. 1000 crores, at current prices. The financing institutions have a big task ahead, and have to make a determined effort to meet it successfully.

TABLE 6.1 : HOURS OF USE OF DIESEL PUMPSETS BY SURVEYED FARMERS

District (State)	Number of Diesel Pumpsets			Average No. of hours worked during the year	Pumpsets with hours of use during 1977-78					
	Used only for irrigation	For other uses also	Total		300 and less	301 to 500	501 to 700	701 to 1000	1001 to 1500	Above 1501
1	2	3	4	5	6	7	8	9	10	11
Chittoor (Andhra Pradesh)	11	7	18	657	2	4	7	4	1	—
Rajkot (Gujarat)	42	—	42	700	20	3	5	2	8	4
Nasik (Maharashtra)	11	1	12	268	8	3	—	1	—	—
Ludhiana (Punjab)	13	11	24	490	12	6	—	3	2	1
Coimbatore (Tamil Nadu)	7	—	7	700	1	1	2	2	1	—
Meerut (Uttar Pradesh)	17	9	26	890	5	2	4	7	3	5
<b>Total</b>	<b>101</b>	<b>28</b>	<b>129</b>	<b>—</b>	<b>48</b>	<b>19</b>	<b>18</b>	<b>19</b>	<b>15</b>	<b>10</b>

TABLE 6.2 : HOURS OF USE OF ELECTRIC PUMPSETS BY SURVEYED FARMERS

District (State)	Number of Electric Pumpsets			Average No. of hours worked during the year	Pumpsets with hours of use during 1977-78					
	Used only for irrigation	For other uses also	Total		300 and less	301 to 500	501 to 700	701 to 1000	1001 to 1500	Above 1501
1	2	3	4	5	6	7	8	9	10	11
Chittoor (Andhra Pradesh)	32	8	40	525	9	13	9	9	—	—
Rajkot (Gujarat)	5	—	5	682	1	—	2	1	1	—
Nasik (Maharashtra)	61	—	61	469	25	13	8	10	4	1
Ludhiana (Punjab)	26	12	38	1108	3	4	6	5	11	9
Coimbatore (Tamil Nadu)	55	—	55	747	11	14	9	8	6	7
Meerut (Uttar Pradesh)	15	6	21	1550	—	2	2	3	5	9
<b>Total</b>	<b>194</b>	<b>26</b>	<b>220</b>	<b>—</b>	<b>49</b>	<b>46</b>	<b>36</b>	<b>36</b>	<b>27</b>	<b>26</b>

**TABLE 6.3 : CONSUMPTION OF DIESEL OIL AS REPORTED BY THE FARMERS SURVEYED**

District (State)	Horse Power of engine	No. of Diesel Engines		Diesel Consumption per hour (in litres)			
		ISI mark	Non-ISI mark	I.S.I.		Non-I.S.I.	
				Average	Range	Average	Range
1	2	3	4	5	6	7	8
Chittoor (Andhra Pradesh)	5	5	6	1.11	1.00 to 1.29	1.05	0.87 to 1.17
	6	1	3	1.08	1.08	1.05	1.00 to 1.10
	7.5	—	3	—	—	1.15	1.13 to 1.25
Rajkot (Gujarat)	5	13	25	1.46	1.00 to 1.95	1.15	0.90 to 1.67
	6	—	2	—	—	1.39	1.15 to 2.00
	7	—	2	—	—	1.41	1.20 to 2.10
Nasik (Maharashtra)	5	10	2	0.75	0.53 to 1.00	0.79	0.78 to 0.96
Ludhiana (Punjab)	5	10	7	1.06	0.95 to 1.20	1.20	1.00 to 1.56
	6	2	1	1.12	1.05 to 1.22	1.25	1.25
	7.5	—	2	—	—	1.30	1.20 to 1.34
	10	1	1	1.60	1.60	1.27	1.27
Coimbatore (Tamil Nadu)	5	1	2	1.37	1.37	1.25	1.12 to 1.43
	6	1	2	1.40	1.40	1.35	1.25 to 1.45
	8	—	1	—	—	1.47	1.47
Meerut (Uttar Pradesh)	5	9	3	1.09	1.00 to 2.09	1.15	1.00 to 1.75
	6	5	3	1.20	1.03 to 1.82	1.45	1.00 to 1.60
	8.5	—	2	—	—	1.28	1.22 to 1.34
	10	1	2	1.80	1.80	1.54	1.30 to 1.78
	17	—	1	—	—	2.50	2.50

TABLE 6.4 : COMMERCIAL AND CO-OPERATIVE BANKS' FINANCE FOR PURCHASE OF PUMPSETS

State	Disbursement of loans by Commercial Banks for purchase of pumpsets during 1977-78				Disbursement of loans by LDBs and CCBs for purchase of pumpsets during 1976-77			
	No. of Accounts		Amount (Rs. lakhs)		Amount (Rs. lakhs)		Estimated number* of pumpsets	
1	2		3		4		5	
Andhra Pradesh	..	..	..	..	2876	111	688	17,829
Assam	..	..	..	..	27	1	6	162
Bihar	..	..	..	..	7235	328	650	14,336
Gujarat	..	..	..	..	4562	121	119	4,487
Haryana	..	..	..	..	412	20	11	227
Himachal Pradesh	..	..	..	..	416	7	4	238
Jammu & Kashmir	..	..	..	..	31	2	1	15
Karnataka	..	..	..	..	2600	92	179	5,059
Kerala	..	..	..	..	4096	92	114	5,076
Madhya Pradesh	..	..	..	..	11353	396	1216	34,862
Maharashtra	..	..	..	..	3906	136	475	13,642
Orissa	..	..	..	..	590	19	104	3,230
Punjab	..	..	..	..	1370	51	1031	27,693
Rajasthan	..	..	..	..	5861	273	505	10,842
Tamil Nadu	..	..	..	..	776	32	2	48
Uttar Pradesh	..	..	..	..	11984	746	1988	31,936
West Bengal	..	..	..	..	4193	181	569	13,180
<b>All India</b>	..	..	..	..	<b>62671</b>	<b>2620</b>	<b>7676</b>	<b>1,83,592</b>

Source : Reserve Bank of India.

\* The numbers were calculated by dividing the disbursement amounts by estimated amounts of loan per pumpset for different states.

TABLE 6.5 : EXPECTATION OF SAMPLE FARMERS ABOUT SOURCES OF FINANCE FOR REPLACEMENT OF PUMPSETS

District (State)	No. of sample farmers	Source of finance for future replacement				
		Owned funds	Will seek loan because			
			No surplus/ lack of fund	Other liabilities	Heavy investment	Undecided
1	2	3	4	5	6	7
Chittoor (Andhra Pradesh)	.. 40	4	—	—	28	8
Rajkot (Gujarat)	.. 39	31	8	—	—	—
Nasik (Maharashtra)	.. 40	30	8	—	—	2
Ludhiana (Punjab)	.. 40	16	20	—	4	—
Coimbatore (Tamil Nadu)	.. 40	12	5	10	—	13
Meerut (Uttar Pradesh)	.. 40	27	5	3	—	5
<b>Total</b>	.. .. 239	120	46	13	32	28

## CHAPTER VII

### SUMMARY AND RECOMMENDATIONS

7.1 The Committee was required, among other things, to (i) estimate the demand for irrigation pumpsets, (ii) enquire into the repair and maintenance facilities available to the farmers, and (iii) examine the present loan policy and procedure and the repayment system adopted by financing institutions and suggest rationalisation thereof, if needed, based on the economic life of pumpsets as well as the additional income generated by such investments for the different types of farmers (1.2).

7.2 As regards the expected demand for irrigation pumpsets, this has been estimated by the Committee under three broad heads : (i) the demand for electric pumpsets (Chapter II), (ii) the demand for diesel pumpsets (Chapter III) and (iii) the demand for replacement of old pumpsets (Chapter IV).

7.3 The demand for electric pumpsets has been estimated under three alternative methods, one based on the projections of the linear growth rate of the total number of pumpsets in each state, the second based on the projection of compound growth rate of the number of pumpsets and the third based on a projected number of villages electrified and an assumed number of pumpsets per electrified village. For the country as a whole, the estimated total number of electric pumpsets in March 1983 by the first method comes to 43.7 lakhs, by the second method to 50.0 lakhs and by the third method to 44.7 lakhs. Thus, the three alternative methods of estimates give a minimum of 10.7 lakh units and a maximum of 17 lakh units to be added to the existing number of electric pumpsets over a period of 5 years ending March 1983 (2.13).

7.4 These three alternative methods of estimation are essentially extensions of past trends. However, the past trends may not always continue in future either because of other factors constraining such extension or because of operation of factors that may lead to better performance than in the past. It is, therefore, necessary to take into account as many of these factors for which any information is available, before making a final estimation of the demand for pumpsets during 1978-83. This has been attempted, state-wise (2.14 to 2.33).

7.5 A sum total of these state-wise projections shows that one may reasonably expect an addition of about 15 lakh new electrical pumping units during the 5 years 1978-83. This is somewhat less than the 17 lakh new units projected by one of the three alternative methods, but much lower than the 20 lakh units targeted by the Working Group of the Planning Commission. The experience during the first year of the current Plan does not appear to us to justify the Planning Commission's much higher hopes in this matter (2.34).

7.6 The estimation of the demand for diesel pumpsets presented difficulties as data on number of pumpsets installed for irrigation during the last 7 years were not available readily (3.1).

7.7 The Committee had, therefore, to resort to estimating the total additions by an indirect method i.e., by using the data available on single cylinder fuel injection pump

as this is an inevitable component of every diesel engine that operated an irrigation pump (3.2).

7.8 On the basis of necessary adjustments for stocks, exports, etc., of both fuel injection pumps as well as diesel engines, the Committee estimated an annual average addition to diesel pumpsets during the 1978-83 period to be about 2.36 lakh units. This implied that during the 5 years of the current Plan, the total number of additional diesel pumpsets likely to be demanded would be 12 lakh units (3.13).

7.9 In addition to the new demand for pumpsets—diesel or electric—a third source of demand expected was for renewal or replacement of old/worn out pumpsets (4.1).

7.10 This depended, among other things, on the life of the pumpsets. The life expectancy of the diesel/electric pumpset in use in different parts of India would be different depending upon the intensity of their use. On the basis of the average number of hours a pumpset worked, it was found in the limited survey conducted for the purpose that the life expectancy of the diesel engines in use was between 17-18 years and in the case of electric motors, the life expectancy in one State was 14 years and in all the other 5 States more than 18 years (4.10).

7.11 Based on the actual use pattern of pumpsets and experience with them, the Committee found no reason to expect a demand for renewal of electric pumpsets in less than 17 years from the date of commissioning in almost all regions of the country. Thus, a diesel or electric pumpset commissioned before the end of 1966 may reasonably be expected to be due for replacement by 1983. On this basis, we may expect all diesel and electric pumpsets commissioned before 1966 to be replaced by 1983 (4.12).

7.12 This cannot be said of all the diesel pumpsets which had been commissioned by 1966, for diesel engines have been replaced by electric motors following electrification of the villages long before the expiry of the normal life span. It may not, therefore, be very unreasonable to assume that most of the diesel pumpsets of 1966 or earlier date have either already been replaced by electrical units or will be replaced by the end of the current Plan period. The Committee, therefore, estimates the replacement demand for old/worn out diesel pumpsets by new diesel pumpsets to be negligible (4.13).

7.13 The only relevant replacement demand will be that of electrical pumpsets. The Committee expects the total replacement demand on this account to be no more than 3 lakhs for the period 1978-83 assuming a 17 year period for replacement demand (4.14).

7.14 Thus, the expected total demand for diesel and electric pumpsets during 1978-83 is estimated at 30 lakh units consisting of 12 lakh diesel pumpsets and 18 lakh electrical pumpsets. The 18 lakh electrical pumpsets include 15 lakh units to be newly installed and for replacement of diesel pumpsets and 3 lakh units to be on replacement of worn-out electric pumpsets (4.15).

7.15 The Committee was required to enquire into the repair and maintenance facilities available to the farmers using diesel or electric pumpsets for irrigation. According to the survey conducted in six districts, the cultivators, by and large, ex-

pressed satisfaction at the repair and maintenance facilities available to them for their diesel and electric pumpsets. Most of the respondents got their minor repair work attended to by the mechanics available in and around the villages (5.4).

7.16 In areas where the use of pumpsets was widespread, a sizeable number of repair and maintenance service personnel and workshops had developed to cater to the needs of the farmers and the farmers were generally satisfied with the facilities available. This, however, does not mean that the services available were always up to the mark. It was found by the technical consultants appointed by the ARDC that in States like Andhra Pradesh and Uttar Pradesh, 20 per cent to 25 per cent of the sample engines examined by them suffered from poor maintenance and consequently, reduced efficiency. The farmers were not always in a position to notice this (5.6).

7.17 In areas where the irrigation pumpsets were relatively less numerous, private repair and maintenance service took time to come up. In the Eastern States of Bihar, West Bengal and Orissa, it was reported that the level of repair and maintenance service was extremely poor in terms of both quality and frequency. Mechanics were reported to have made alterations ostensibly to help in starting the engines and these had resulted in reduced thermal efficiency and increased wear and tear (5.7).

7.18 The Committee is of the view that efforts should be made by different agencies in the field to promote suitable repair and maintenance personnel/agencies particularly in areas where lift irrigation is comparatively new. The manufacturers of engines and pumps or their dealers should pick up and train mechanics and qualified technicians to attend to the various problems of the pumpsets and finance this training. Similarly, the financing agencies operating in the areas may pool their resources and help in training a few local mechanics and technicians in this business. The newly created district industrial centres can also lend a helping hand in this direction. A co-ordinated effort by these different agencies would help in overcoming the deficiency in the repair and maintenance service, especially in areas where the facilities are inadequate, and avoid inconvenience and loss to the farmers (5.9).

7.19 Loans for purchase of pumpsets or for the combined purpose of sinking a well or tubewell and putting up a pumpset are advanced in the country primarily by the Land Development Banks, State and Central Co-operative Banks and the Commercial Banks. Occasionally, private voluntary agencies working in rural areas manage to collect funds and advance them to farmers for this and other investment purposes, though it is insignificant as compared to the total loans made available for the purpose. The Reserve Bank of India has from time to time laid down guidelines to the co-operative financing institutions about the conditions of financing. The considerations underlying the guidelines laid down and the practices followed emphasise that the loan fund should be made available to potentially productive borrowers, the loan fund should not remain unrepaid for a period longer than what is necessary, the loan fund is used for the purposes for which it is given and the farmer invests the fund in equipments appropriate to his requirements and is not overcharged by the sellers (6.3).

7.20 After a few years of experience, the Reserve Bank of India found it necessary to review these guidelines as they had not been properly interpreted. It was found that financing institutions had sometimes advanced loans for pumpsets to parties who did

not have a reasonable area of land in a block around their well. The Bank, therefore laid down supplementary guidelines subsequently. In these guidelines, it was indicated that loans for pumpsets may generally not be given to borrowers with less than a compact area of 3 acres near the well or the tubewell (6.5).

7.21 This guideline would not have been necessary had the original guidelines been properly followed by the financing agencies. As long as three acre limit is interpreted not as a rigid rule but only as a reminder that this aspect has to be carefully examined, this guideline can do no harm. But in all these matters, there is often a tendency to interpret such indicative guidelines as definite permissions or prohibitions. Under such circumstances, there is a danger that genuine and economically viable cases may be precluded. The Committee, therefore, is of the view that the RBI may be requested to modify or clarify its directive in such a manner that deserving farmers are not deprived of the benefit of loans for not having at least 3 acres in a compact block (6.6).

7.22 Another guideline from the Reserve Bank relates to the length of the period over which the borrowers may be allowed to spread repayment. The Land Development Banks and Co-operative Banks were advised some time back that loans for only pumpsets (operated by electric or diesel engines) should ordinarily be for 7 years. An important ground for the 7-year period appears to be the useful or economic life of a pumpset based on a norm of working hours for a pumpset in a year. A rigid interpretation of this guideline is likely to lead to rejection of loan applications in situations where the request may otherwise be justifiable on economic grounds (6.7).

7.23 On the ground of actual experience, farmers were found to have generally used their diesel or electric pumpsets for 12 years at a stretch and expected to do so for at least another 5 to 6 years before it may become necessary to replace the equipment. This, in the Committee's view, suggests that where necessary the repayment period may be extended beyond the 7-year limit without risking the repayment of the loan on the ground of expiry of the working life of the pumpset (6.9).

7.24 The recommendations to relax the current 7-year period does not mean that all loans for pumpsets should have a longer repayment period. There will be cases, particularly of large and even medium farmers, where the available surplus net incremental income after meeting the normal increase in family expenditure may turn out to be large enough to enable repayment, say, in 5 years. In such cases, repayment schedule should be worked out for 5 years. But where the estimated surplus income appears adequate for repayment only if the repayment period is extended, such extension should not stand in the way of sanction of the loan. The recommendation of the Committee to extend the period of loan beyond 7-year limit does not mean that the Committee suggests extension of the limit from the present 7-year period to 17 years i.e. the expected life of the pumpset estimated on the basis of the survey. In most cases, it is not anticipated that a longer period of repayment beyond 10 to 12 years would be necessary (6.11).

7.25 Besides small farmers and such others, extension of the repayment period may become necessary in cases where the water supply in a well may turn out to be inadequate upsetting the calculations of incremental income estimated at the time of the appraisal. In such cases, an extension should be considered legitimate and the repayment schedule should be worked out afresh as a matter of course after due technical clearance to facilitate servicing of the loan (6.12).

7.26 Another consideration underlying the Reserve Bank's guideline of loan operations of the financing institutions is that the loans should be used for the purposes for which it is given. In order to ensure this, the Reserve Bank advised the banks not to make cash payment to the borrower but to make the payment directly to the dealer who sells the pumpset to the borrower on the basis of invoice. The banks were also advised to take special care to scrutinise the invoices given by the suppliers for over-invoicing. Despite these guidelines, field studies by the banks reveal a number of malpractices. In view of this, the Bank issued a supplementary set of guidelines (6.15, 6.16 and 6.17).

7.27 The Committee felt that it would be inadvisable to give the loan amount directly to the borrower for purchase of pumpset, when the bank is in a position to make the payment on his behalf to the dealer on receipt of the invoice. The Committee endorses the guidelines laid down by the Reserve Bank, since these guidelines not only improve the utilisation of the loan for the purposes intended but also ensure better service and quality of equipment to the farmers (6.18).

7.28 The question that remains to be examined is the type and quality of engine/motor/pumpset, the purchase of which the financing institutions may finance. The Reserve Bank's guideline is to see that the farmer invests his funds in equipment appropriate to his requirements. The question of the selection and distribution of pumpsets under various loan schemes was discussed in a meeting of the Government of India, the various State Governments and financing agencies, and the Reserve Bank of India in July 1977. The recommendations that emerged out of these discussions were subsequently endorsed by the Government of India, who have asked the State Governments to set up the necessary organisation (6.20).

7.29 The procedure outlined in these recommendations, according to the Committee, will not only ensure provision of a common list of approved suppliers/manufacturers in each state but also help create a machinery at the state level where even the small local manufacturers can bring their product for quality certification. This should go a long way in not only meeting the requirement of providing the possibility of selection of the products of small manufacturers but also gradually lead to an improvement in the quality of the production around (6.21).

7.30 The Committee finds that the farmer rarely gets advice from any competent agency about the equipment appropriate for his site and work and most of the farmers depended on themselves or their neighbours in making the choice. At present, there is no provision to check and see if the equipments for which the farmer is seeking a loan are appropriate to his requirements. A verification on this may not only alter the estimated investment sum but also ensure economic working of the pumpset, thereby increasing the incremental income. The Committee is, therefore, of the opinion that all the financing institutions should require the applicants for loans for pumpsets to specify details of the equipment needed, their estimated cost and the detailed cost of installation. The financing agency itself should get these details verified by asking a qualified technical person to visit the proposed site of the investment and give specific recommendations on the technical requirements of the applicant. The economics of the investments should be worked out only after this and the loan sanctioned, if found satisfactory. The Committee suggests that this technical scrutiny must be an integral part of the procedure for sanctioning the loan (6.23).



7.31 There is another matter relating to the present financing procedure. In working out the repayment sum every year, while the co-operative financing institutions calculate repayment on the equated instalment basis, the commercial banks charge equal instalments of the principal every year plus the interest on the outstanding principal. According to the latter, the farmer is required to pay a larger total sum in the beginning, with the annual total payment diminishing in subsequent years. The Committee finds this rather unhelpful to the farmer and suggests that the commercial banks may adopt the equated instalment method followed by LDBs for repayment of loans (6.25).

7.32 The Committee has also made an attempt to estimate the number of total pumpsets that the financing institutions may be expected to finance during 1978-83. According to the Committee, the financing institutions may be required to finance about 20 lakhs out of the estimated demand of 30 lakh units (6.27).

7.33 As regards the demand for replacement of worn out pumpsets, considering the fact that such replacement demand may be about 3 lakh units at the most and indications are that not more than half of the concerned farmers are likely to seek loan for the purpose, the Committee did not think it necessary at this stage to lay down any specific guidelines in the matter (6.29).

7.34 The estimated total loan finance requirements during 1978-83 at the rate of about Rs. 5,000/- per pumpset is placed by the Committee at around Rs. 1,000 crores at the current prices. The financing institutions have to make a determined effort to meet the big task ahead successfully (6.30).

**NILAKANTHA RATH**  
*Chairman*

**R. S. SAKSENA**  
*Member*

**S. V. R. RAO**  
*Member*

**R. R. NAIR**  
*Member*

**A. NARASIMHA REDDY**  
*Member*

**K. C. BERRY**  
*Member*

**V. R. JOSHI**  
*Member*

**V. S. DABHOLKAR**  
*Member*

**Y. S. BORGAONKAR**  
*Member*

**S. V. BOPARDIKAR**  
*Member*

**P. RAMAN**  
*Member-Secretary*

Bombay,  
August 6, 1979

**APPENDIX A**  
**Meetings of the Committee**

	Members	Meetings on				
		18th Oct. 1978	21st March 1979	6th June 1979	23rd June 1979	6th August 1979
1.	Shri Nilakantha Rath (Chairman)	P	P	P	P	P
2.	„ R. S. Saksena	P	A	A	P	A
3.	„ S. V. R. Rao	A	A	P	P	A
4.	„ R. R. Nair	P	A	A	(a)	P
5.	„ A. N. Reddy	P	A	P	P	P
6.	„ K. C. Berry	A	A	P	P	P
7.	„ V. R. Joshi	.. P	A	A	P	P
8.	„ V. S. Dabholkar	.. A	P	P	P	P
9.	„ Y. S. Borgaonkar	.. P	P	P	P	P
10.	„ S. V. Bopardikar*	—	A	A	P	A
11.	„ P. Raman	.. P	P	P	P	P
12.	„ V. V. S. Mani (invitee)	P	P	P	P	—

(a) Shri D. M. Umrigar and Shri P. N. Thiagarajan attended on behalf of Shri Nair

\* Nominated on 25-11-78

P=Present, A=Absent

**APPENDIX B**

**Organizations Which Supplied Information to the Committee**

**A. Data on village electrification and energisation of pumpsets**

1. Rural Electrification Corporation, New Delhi
2. Central Electricity Authority, New Delhi
3. State Electricity Boards—Andhra Pradesh, Bihar, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, West Bengal, Pondicherry

**B. Data on production and sale of fuel injection equipment**

1. Motor Industries Co. Ltd., Bangalore
2. Fuel Injections Ltd., Bombay

**C. Data on sale of diesel engines/pumps**

1. Kirloskar Oil Engines Ltd., Pune
2. Cooper Engineering Ltd., Pune
3. Vijay Engineering Works, Rajkot
4. Patel Manufacturers, Rajkot
5. Rocket Engineering Corporation, Ahmedabad
6. H.T.C. Diesel Engines Pvt. Ltd., Bombay
7. J. K. Santosh Agricultural Machines Ltd., Kanpur
8. Sarada Engineering Co., Hyderabad
9. Velumani Engineering Industry, Coimbatore
10. Indian Oil Corporation, Bombay

## APPENDIX B (Concl.)

### D. Price Lists, Handouts and other information

1. Indian Diesel Engine Manufacturers Association, Bombay.
2. Bhangar Bros. and Co. Pvt. Ltd., Bombay
3. Calama Industries Pvt. Ltd., Bombay
4. The National Electrical Industries Ltd., Bombay
5. Saga Windel Engineers, Pvt. Ltd., Ahmedabad
6. Rohini Engineering Works, Pvt. Ltd., Miraj
7. British Electrical and Pumps, Pvt. Ltd., Calcutta
8. Bareja Vogel Pumps, Pvt. Ltd., Calcutta

### E. Information on loans disbursed for pumpsets

The Co-operative Central Land Development Banks of Andhra Pradesh, Assam, Karnataka, Madhya Pradesh, Maharashtra, Manipur, West Bengal, Goa, Pondicherry

### F. Ministry of Food and Agriculture, Government of India, New Delhi

### G. The Regional Offices of the Agricultural Refinance and Development Corporation

## APPENDIX C

### THE SECRETARIAT OF THE COMMITTEE

Shri P. Raman	Member Secretary
Dr. V. N. Saksena	Deputy Director
Shri. P. Vivekanandan	Development Officer
Dr. K. Ramanathan	Development Officer
Kum. Indumati Jayaraman	Agricultural Economist
Shri. R. K. Prabhu	Clerk
Shri. M. P. Rajan	Stenographer
Shri. V. M. Ranadive	Typist
Shri. M. N. Asai	Typist

### Districts Selected For Field Study, Supervising Officers and Field Staff

<i>Selected District</i>	<i>Supervising Officer</i>	<i>Field Inspector</i>	<i>Field Investigator</i>
Chittoor (Andhra Pradesh)	R. Narasimhulu	P. S. P. Rao	Y. D. Kishore
Coimbatore (Tamil Nadu)	K. Kanagasabapathy S. Ramdoss	— —	— —
Ludhiana (Punjab)	V. N. Saksena V. S. Bhadoriya	Manjit Singh	S. S. Brar V. N. Sachdeva
Meerut (Uttar Pradesh)	V. N. Saksena Niraj Kumar Gupta	J. B. Sharma	U. C. Pande
Nasik (Maharashtra)	G. R. Padmaras	M. V. Metkar	S. J. Mohurle
Rajkot (Gujarat)	R. G. Shaligram	—	A. R. Desai N. V. Patel