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 RESEARCH  
 PROJECT

R.D.R. 19.



RURAL ELECTRIFICATION

by

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1. The U.E.B. has about 40,000 consumers. Only some 25,000 of these are domestic-tariff consumers. Although many of the premises of the other consumers must include dwellings, the total number of people with electricity in their homes cannot be much more than 200,000. Yet the map shows that the U.E.B. main transmission lines now embrace areas of the country which in total contain several million people.
  2. The U.E.B. is very conscious of this paradox, which is due to the fact that the overwhelming majority of the population are rural, live in scattered homesteads and are either absolutely poor or at least short of cash income. The question is whether this combination of circumstances rules out any rapid and major expansion of rural electrification.
  3. The principal obstacles to progress appear to be:
    - (i) lack of interest on the part of the rural community
    - (ii) cost of installation.
    - (iii) cost of electricity.
- Lack of Interest
4. The U.E.B. already has a considerable network of 240 volt overhead distribution line in several populous and relatively prosperous rural areas e.g. in Gomba and Butambala counties and in the area north of Gayaza and east of Bombo. The U.E.B. offers a standard connection charges of \$ 60/- up to 60 yds. from a 240 volt distribution line, yet finds that a surprisingly large number of people with houses within 60 yds do not become customers.
  5. This feature was very evident to the author on a visit to the Gayaza/Bombo area. This is a fertile and heavily cultivated area. A distribution line runs close to the principal road for many miles. There are numerous well-built and substantial houses quite close to the road, of which only about half have electricity connections. Along the road virtually none of smaller and poorer dwellings have electricity. In the small trading centres however the proportion of buildings with electricity is much higher, even including quite small and roughly-built structures.
  6. What part is played in this pattern by ignorance, by apathy, by prejudice and by presence or absence of social competition?.
  7. The U.E.B. 1964 Annual Report (para 36) records that "In keeping with the Board's belief in the personal touch as the greatest boost to development, every effort was made throughout the year to educate and stimulate the public towards increased and efficient use of electricity. Through the operation of the commercial staff, door-to-door canvassing, demonstrations, home visits, lectures and talks have been energetically carried out in most areas where the Board's supply is available."

8. The apparent lack of interest for this promotional work in rural areas raises a number of questions to which answers can only be found by further investigation or experiment. Is the publicity specifically designed to emphasise the advantages of electricity for rural living? Is there a real prejudice to be over-come, or is there a straight preference for spending money on something else instead of electricity? Does any such preference consciously take into account the interests of all members of the household - including those of the schoolchildren? Some study of these points and of the publicity methods used, might be productive.

#### Cost of Installation

9. The householders' cost of installing electricity can be divided into two parts -
- (a) the cost of bringing electricity to his dwelling
  - (b) the cost of wiring the dwelling and buying lamps and apparatus.
10. The U.E.B.'s \$s 60/- connection charge, as indicated in para 4 above, includes service connection up to 60 yds. from a 240 volt distribution line. For a dwelling which is 60 yds away, this represents a considerable undercharge by U.E.B. The average cost of a 50 yds service connection is \$s 150/- of which \$s 80/- is materials. For instance beyond 60 yds, the charge is \$s 3/- per yard, which rapidly mounts up to a sizeable sum. For example, a house situated a quarter of a mile from the distribution line would incur a total cost of \$s 260 to be connected.
11. The cost of wiring a house varies considerably according to the type of work, and also varies between contractors. Small and simple contracting organizations charge from \$s 15/- to \$s 25/- per lighting point, depending on whether conduits are used, whether the wiring is chased into plaster, etc. Power points cost about \$s 35/-. Major contracting companies with engineering overheads charge from \$s 25/- to \$s 40/- or even \$s 60/- per lighting point. Thus a typical modest with five lighting points and one power point cost about \$s 140/-. Together with the minimum connection charge this makes \$s 200/-. This sum would be considerable to a small peasant farmer, but is clearly a small item compared with cost of many of the better rural houses which are not connected.
12. As a rough generalization, for people able to afford good houses near a distribution line, the cost of installation would scarcely be the decisive factor. But for people even only a quarter of a mile away, total installation costs could well be decisive even if they were otherwise keen to have electricity.
13. There is an additional factor which does sometimes, but should not, affect the installation of electricity. In some cases self-styled contractors have taken money from householders as advance payment for wiring, and then failed to install a satisfactory system or even done no work at all. This not only robs these people of their money and the U.E.B. of customers, but also the risk of it is may well discourage other people in the same area.

#### Cost of Electricity

14. The U.E.B. domestic tariff is a normal three step structure designed to make the usual approximate contributions to overheads and to operating costs. It is:-
- Step 1. for the first 6 units per room month \$s 1/- per unit
  - Step 2. for the next 18 units per room month \$s -/30 per unit
  - Step 3. for the rest \$s -/14 per unit

15. The effect of this is obviously that heavy users of electricity (e.g. those who use it for cooking and for heating water) get their marginal units at a rate which on any standard is cheap. But those who use only a small amount, e.g. just for lighting, or who use a moderate amount e.g. lighting, an electric iron and a kettle, but who have many rooms, pay a high average charge per unit. They may easily get on to the 2nd step, thus paying 1/- per unit, and incurring a bill of 10/- to 20/- per month for lighting and perhaps ironing and boiling water. Compared with kerosine at 3/30 per gallon, this is probably of roughly the same order of cost for equivalent illumination and heat.
16. The actual cost of electricity however is probably not the only consideration. There is also the obligation to produce a sum of money at regular intervals. This budget table for a wage-earner, but may well be difficult for a peasant cultivator at certain times of year. Yet if he consumes and does not pay he is cut off - and incurs a reconnection charge. And if he just refrains from consuming he has wasted his money on the installation. Although he has no compound interest tables, he probably has an instinctive sense of the disutility of locking up capital. A 200/- installation written off over 10 years at 20% interest is worth 47/- a year or nearly 4/- a month.
17. The practice of building houses with many fairly small rooms must also tend to increase the householder's electricity bill.
18. To overcome some of these difficulties the U.E.B. introduced several years ago its consumer unit board tariff. For a fixed sum of 8/50 a month a consumer could have as much electricity as he could use up to a limit of 1 amp load. A larger unit gave him up to 5 amps for 20/- a month. The U.E.B. has now discontinued the 5 amp boards, as its average revenue per unit sold was too low. In any case it has been found that many consumers prefer to pay on a meter for the units actually consumed. Incidentally the U.E.B. meets the capital cost of either the consumer unit board or the meter. (A meter costs 140/-)

#### Possibilities for Progress

19. On the lack-of-interest problem, there may well be scope for some examination of the sales promotion methods. But the main driving force would probably have to be a general campaign to persuade the rural population to improve their housing conditions with electrification as one of the features in those areas where distribution lines are available or can be readily be made available.
20. On the cost side, it would appear that connection costs will be a very important factor, except for a relatively few rural households near the distribution lines, even when an active desire for electricity has been created. These costs are to some degree incompressible; e.g. insulated cable costs about 1/- per yard. It would however appear to the author that substantial economies could be effected by allowing the rural population to adopt some very unorthodox methods.
21. For example, the U.E.B. might take its 240 volt local distribution line to a certain terminal point, and provide it with electrical protective devices for overload and surge limitation, and with a meter. Beyond this point the U.E.B. would take only a very limited interest in the installation, apart from collecting its money. People would be free to sling wires on trees, on house eaves, bush poles, etc. as they pleased. They could run wires from house to house successively, across the country side. They could make their own arrangements for meeting and sharing the installation costs and their own rules for way-leaves across each other's land.

22. A bare minimum of regulation would probably be needed. All cable would be insulated. Cable across or along roads would be securely fixed and with a specified minimum clearance height. The radius of distribution on each such rural net would be checked, to keep within the maximum. Equipment approved for sale to rural areas would be fully fused and earthed.
23. The U.E.B. might collect its charges in the normal way, through its monthly travelling demonstration van. The meter on its terminal point would give the Board a rough check on whether it was collecting from all the consumers. Alternatively the consumers taking from a given terminal point could be required to form a co-operative which would buy in bulk from the U.E.B. and collect revenue from its members.
24. A cadre of rural installation technicians would be needed. These could easily be trained in one of the Technical Schools to a practical standard designed for their work. They could not be government employees or U.E.B. employees. They would probably be self-employed artisans, carrying out installation work for individual householders or for groups of householders. They would have sufficient knowledge to avoid over-loading their systems and to spot dangerous alterations made by amateurs.
25. On the wiring of dwellings it would appear possible to develop some type of standardized harness which could be installed quickly and easily, preferably when a house was being built. This would be a factory-made assembly which only needed nailing into position.
26. By these means the capital cost of installation might be sufficiently reduced to bring a large number of rural dwellings within the supportable cost limit. Undoubtedly there would be some greater degrees of risk in a distribution system on these lines than in one conforming to full engineering standards. But the rural installation electricians, the use of insulated cable, and the liberal use of fuses would probably reduce this risk differential to quite modest proportions.
27. While some degree of risk would have to be accepted this, like all technical progress, has to be set against the advantages - few fires and burns from paraffin lamps and cookers, better light for reading and especially for schoolchildren's study, greater rural security because lights could be put outside houses, electric power for borehole pumps, and so forth. The risks in relation to the benefits would probably be at least as favourable as those of, say, motor traffic.
28. The actual electricity tariff at once raises the question of whether charges should be lowered to stimulate consumption. The 3-step tariff is designed to do this, by reflecting roughly the cost structure of electricity supply. It does however only really work this way for a fairly heavy domestic consumer. Should the tariff for rural consumers be altered so as to give them a lower average price per unit? It is not unknown for electricity concerns to offer both a stepped tariff and flat-rate tariff, and in Uganda's case the flat-rate would probably be of the order of \$s -/50 to \$s -/60 (the average revenue per unit sold on the domestic tariff in 1964 was \$s -/31).
29. An alternative would be to define the steps so that rural houses with a multiplicity of small rooms could at least get on to step 2.
30. In all these permutations and combinations of charges however it is important to calculate when there is outright subsidization and when there is marginal revenue exceeding marginal cost - but not equalling average cost. With the need to build another hydro-electric station now looming up, it is no longer plausible to argue that electricity at Jinja should be treated permanently as a free good, and charges be levied only for distribution. It might however be argued that a special rural tariff should be introduced in order to stimulate rural load, so that when the new power station is installed its total generating capacity can be brought into use as soon as possible. Such calculations are a combination of precise costings and commercial judgement, and are beyond the scope of this memorandum.

Conclusion

31. The primary purpose of this memorandum has been to ventilate various issues and to give at least some of the relevant background data. There is clearly plenty of scope for further study, social, technical and economic.
32. The seminar may feel that its most useful function would be to define what are the most fruitful further lines of enquiry.

March, 1966.

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