CHAPTER 13

New technology

Introduction

13.1 In considering the relevance to our inquiry of major changes in technology, we have relied mainly on evidence from the four boards, supplemented by the views of the Electricity Council. We asked the boards about:

(*a*) the nature of possible/probable technical changes relevant to the reference activities;

(*b*) the time periods within which changes might occur; and

(*c*) their views of the relevance to our inquiry of the nature and probable time-scale of technical changes.

13.2 Discussion of 'new technology' by the four boards has assumed that the conventional function of metering would continue into the foreseeable future, but that rather dramatic changes could occur in the recording and transmission of information about the number of units consumed and the cost of consumption; and possibly in the means of payment for that consumption. The boards' discussions of new technology for the reference activities have, therefore, centred on:

(*a*) changes in metering hardware;

(*b*) the means of transmitting information about the number of units consumed to a separate location;

(*c*) the provision to an individual customer of more information than is currently available about physical consumption and its cost; and

(*d*) electronic means of payment.

13.3 In the following paragraphs we summarise, using mainly the words of the boards themselves, their views on changing technology. Paragraphs 13.4 to 13.17 are based on SEEB's evidence which, perhaps because of SEEB's pioneering work in the Credit and Load Management System (CALMS), was the most comprehensive. In the subsequent paragraphs (13.18 to 13.32) we note additional points which reflect the particular views and concerns of the three other boards.

SEEB's views

13.4 The routes by which economic progress in supplying electricity has been achieved in the past (ie the use of higher steam pressures and temperatures in power stations, high transmission voltages and nuclear power, etc) appear to be approaching limits of economic technical improvements. Consequently the 'law of diminishing returns' has been operating for some time, leaving little scope for further economies of scale. In the search for increased economic efficiency, electrical utility interest has been concentrated on:

(*a*) load management—where the attention has largely focused on peak lopping and transference of load from day to night;

(*b*) tariffs—these tie credit and load management together, but the advent of new and flexible tariffs, particularly in the domestic area, has been limited by the availability of economic metering;

(*c*) credit management—work in this area has been concentrated on remote meter-reading but time of day metering and improved payment systems are also being considered; and

(*d*) communications—with each customer in an economic manner. Whilst load management can largely be accomplished by a one-way communication, credit management requires two-way communication and it is the latter area which is receiving most attention.

13.5 According to SEEB recent advances in micro-electronic techniques have made possible the construction of metering and associated equipment of an unprecedented complexity. A decision was taken to establish an energy management task force (EMTF) under the aegis of the Electricity Council to co-ordinate the developments being made by SEEB and others in pursuit of systems for achieving savings to both utility and customers. Subsequently funds have been made available by the Electricity Council, and the Working Party on Energy Management (WPEM) is currently involved in reporting the progress of three field trials to the Electricity Council and in formulating the suggested policies for future development. The three trials currently taking place are described briefly below:

(*a*) *Mainsborne Signalling*

In this system the emphasis is on communication along the mains distribution network. A central controller is situated in the transformer chamber at the distribution sub-station, and linked by telephone to a central computer. At customers' installations a 'home unit' is provided which receives information from electricity, gas and water meters, and performs load and tariff switching. A customer display unit gives usage and cost information. One thousand homes are involved in the trial in London and Milton Keynes.

(*b*) *Radio Teleswitch*

The system is based on the use of BBC Radio 4 200KHz long wave transmissions, which give national United Kingdom coverage. Encoded data signals are superimposed on the transmissions. These can be received by equipment installed on customers' premises, providing load and tariff switching on a pre-programmed basis, at times pre-set by radio broadcast, or immediately under control of radio broadcast. One thousand five hundred teleswitch units are currently being tested by area boards.

(*c*) *CALMS*

The Credit and Load Management System, which is based around an integrated metering, management, display and communications device (the CALMU meter), at present uses telephone and radio links for communication.

CALMS

13.6 SEEB told us that CALMS is currently undergoing field trials which will eventually involve 300 customers in South Eastern, Midlands and East Midlands Electricity Boards. An interim report, to be followed by a more detailed report giving appraisals based on more comprehensive information, has been submitted to the Electricity Council. This document sets out in general terms the progress of the trial to date and provides specific information in some areas where it is appropriate.

13.7 Results obtained so far indicate a very encouraging customer reaction to the system, which is also performing to a satisfactory standard from the point of view of the utilities. There is a high degree of co-operation between the several nationalised industries taking part, without which a project of this nature would not have been possible.

13.8 Funds are currently being sought from the European Economic Commission to finance a large-scale demonstration project to give confidence to utilities and manufacturers, both in the United Kingdom and other European countries. The project involves the installation of 1,000 CALMU meters. Assuming a favourable outcome, widespread installation can be expected to start in about five years time, and would be expected to take from 10 to 15 years to achieve total penetration and the full associated benefits.

Boards' distribution costs

13.9 In SEEB's view the effect of flattening the generation load curve should, in principle, allow the network distribution system to be designed for a lower system peak maximum demand, but since the total capital expenditure involved in the distribution network is substantially less than in generation, the savings are likely to be small compared with any generation capacity savings. It has not been possible to quantify the distribution revenue savings which might result from flattening of the load curve, but the net effect should be to reduce the system losses involved in supplying the same quantity of energy.

Estimated potential savings in meter-reading, billing and collection

13.10 According to SEEB assessment of the savings in certain areas, for example direct meter-reading costs, is readily performed since both the current costs and revised costs are known with an acceptable degree of confidence. Other current costs, for example bad debts, are known reliably but the level of improvement in these costs brought about by energy management is a matter of judgment. It will depend upon the effectiveness of the system, the response made by customers and the form of controls which are found to be socially acceptable. Potential savings of the magnitude (indicated in paragraphs 13.11 to 13.13) will not be achieved until the CALMS system (or an equivalent system) is installed and in operation throughout the country, which is unlikely to be achieved before the turn of the century. The figures quoted represent a best estimate of the potential that exists but depend upon movements of costs over a period of some 20 years and should be seen in this context.

13.11 It is anticipated that such a system provides scope for making savings, mainly through automation of meter-reading activity. If the existing billing

frequency and arrangements with the customer were maintained, savings estimated at £67 million per annum are potentially available nationally. This figure includes an estimated £30 million per annum saved on the illegal abstraction of electricity throughout the electricity supply industry.

13.12 The possibility of increasing the frequency of normal billing to, say, bi-monthly could lead to further savings, mainly through improved cashflow estimated at £19 million per annum. If prepayment collections were eliminated by extending the system so that payments were made in advance, there would be additional potential savings estimated at £12 million per annum. A more radical change to billing and collections which effectively eliminates the normal billing cycle has potential for making further savings of the order of £57 million per annum. This figure is additional to the £19 million per annum derived from the change to bi-monthly billing above. These estimates relate to the electricity supply industry as a whole.

13.13 SEEB's estimates of the potential meter-reading, billing and collection cost savings could thus total £155 million per annum for the ESI as a whole.

13.14 The penetration of the new system will have an effect on the savings realised, but for the direct costs of meter-reading the relationship will not be directly proportional. For example, implementation to one customer in five in a particular locality will yield very much less than 20 per cent of the potential benefits.

13.15 The savings outlined above will not be realised without full customer co-operation. It is considered that an incentive can be provided by tariff restructuring; one possibility is an attractive and flexible time-of-day tariff.

13.16 SEEB said that both gas and water industries were interested in remote meter-reading and were working closely with the ESI. In both the mainsborne and CALMS projects the device displays the total account and consumption for each of these utilities, and they are also able to communicate with the device in a similar manner to that of the area boards.

13.17 SEEB told us that in its view new meters would not be introduced until they were comparable in cost with conventional equivalents; for example it expected that the cost of the CALMS unit in large scale production would approximate to the cost of a conventional multi-rate meter and timeswitch. SEEB was already limiting purchases of conventional meters to fulfil essential requirements.

Other metering developments

13.18 SEEB told us that several traditional meter manufacturers are actively pursuing the application of new technology metering. For example, precision polyphase solid state meters have been successfully produced for the last six years. Formal approval for single rate and two rate single phase solid state electricity meters has recently been gained, and plans have been announced for a new £2 million manufacturing capability. A prototype add-on multi-rate unit

has been demonstrated, designed to provide additional tariff structures for use with a slightly modified disc meter. It is expected that future teleswitch receivers may provide more than four rates. The Eastern Electricity Board has produced a draft specification for a multi-rate unit, designed to provide five-rate metering as an add-on device to an existing meter. With the exception of radio teleswitch, these developments do not include communications; however provision is made in, for example, the add-on multi-rate device for automatic exchange of data between handheld portable meter-reading equipment and the metering installation.

NEEB's views

13.19 NEEB told us that pending the outcome of the field trials of CALMS, the mainsborne signalling system being tested by EMEB and the tele-control test being carried out, no decision can be taken by the Board which would significantly change the existing technology. The outcome of the field trials is likely to lead to debate within the industry, possibly with international ramifications. The probable out-turn would be a specification for an approved device which area boards would be recommended to adopt over a period of time which could be left to their initiative.

13.20 The facility exists with CALMS to change the whole concept of billing for energy from a credit system to a pre-payment system with considerable long-term savings in staff and an improvement in cash flow sufficient in itself to meet a substantial proportion of the likely costs. The present meter-reading and quarterly billing system for accounts would not be required.

13.21 The alternative to CALMS is a series of phased approaches to the current CALMS position starting from the replacement of existing meters with electronic meters:

(*a*) in all new meter purchases;

(*b*) when recertification changes are required; and

(*c*) in an accelerated programme.

The likely timescales would be:

(*a*) 40 years;

(*b*) 20 years (present meter certification period); and

(*c*) say 5 years.

An impulse device can be provided within the electronic meter to enable an external device to carry out switching instructions of the whole or part of the supply and to record the consumption against time at appropriate rates. A facility for tele-control messages to the external device can be added, and also the facility to enable the device to communicate with the board:

(*a*) over the mains;

(*b*) by special lines, eg cable TV networks; or

(*c*) by telephone lines.

13.22 The advantage of the second approach is that it is phased which enables each part of the chain to be tested, and permits competitive tendering

and a specification flexible enough to deal with future changes in technology and the world market. Its disadvantages are that the early stages appear to offer no apparent cost/benefit over existing technology and that the timescale is likely to be lengthy.

13.23 The effective development of the full facilities of CALMS in external or integrated device form appear to be necessary before any decision to change existing systems can be put beyond the 'act of faith' level.

13.24 With all the uncertainties surrounding the field trials and the development of technology it seems unlikely that decisions will be taken on CALMS or its equivalent much before 1989. The process of installing the system could take ten years. The full development of the system, therefore, represents a technology for the year 2000.

EMEB's views

13.25 In addition to CALMS, mainsborne communication and radio teleswitching EMEB mentioned token meters for which it is currently conducting field trials (see Appendix 10.2, paragraphs 2 to 5). The trials are for debt collection but token meters are seen as a possible opportunity to provide many existing credit customers with an alternative payment method as well as providing an option to existing pre-payment meter customers.

13.26 All of the above have potentially significant benefits but the price of producing them commercially, assuming each becomes technically acceptable, is not yet known and therefore it is not feasible to suggest a probable timetable. With the investment already made for the 2 million meters which are on circuit in EMEB today, coupled with the heavy resources that would be required to change them for one of the above alternatives, it is unlikely that a complete change would be accomplished in less than 15 years, more probably 20 years.

13.27 A close watch has been maintained on data capture equipment at account receiving points. All keyboard-operated machines take longer whilst the customer is waiting than the more up-to-date methods, and speed is an important consideration in providing a good service to customers and reducing the size of queues which occur from time to time in shops. The development of the wand associated with special printing on the account seems satisfactory from a speed point of view but currently is somewhat expensive. EMEB anticipated that the cost of the equipment would steadily reduce.

13.28 EMEB is watching developments in optical fibre and other cable networks and satellite facilities for communications purposes. If these become widespread, they will almost certainly provide a communications facility which it should be able to use. EMEB said that, again, cost would be a critical factor. At present the developments and proposals were too vague to warrant any additional action, but there was a commitment on the Director of Engineering to establish a field trial using wrap-around optical fibre cable on HV overhead distribution lines.

13.29 EMEB can now transmit data from maximum demand metering equipment to the board's central computer using telephone lines, thus

eliminating the need for regular visits to each meter to take readings, remove charts etc, before bills can be produced. EMEB will proceed with the installation of such a system and, although the cost can only be justified at present for the larger metering installations, future expansion is likely. This will enable more detailed tariffs to be implemented so that the costs of purchasing energy at different times can be more effectively recovered; at the same time customers' load management ability will be enhanced by the provision of more information.

SWEB

13.30 SWEB said it considered that the most significant change likely to take place in the longer term included the introduction of remote meter-reading facilities which were likely to be developed by means of reliable mainsborne signalling systems and/or the use of cable TV networks and/or a system such as CALMS. Whilst not directly involved in CALMS it was (through the medium of the Electricity Council and the Chief Engineers' Conference) keeping abreast of developments and the progress of the trials. Bearing in mind the stage of development (eg the need to confirm reliability, security and costs) and the potential cost of introduction SWEB does not envisage the possibility of any large-scale introduction in the short/medium term (ie within the next seven to ten years).

13.31 With regard to other metering/tariff devices SWEB indicated that it was evaluating a number of changes, including participation in field trials of the new type of radio teleswitches, and it was shortly to commence trials of solid state single phase meters and token-operated meters. It confirmed that solid state data loggers (which record consumption data in computer compatible form) were being introduced for relevant large customers.

13.32 SWEB's use of IBS has been discussed in Chapter 10. Additionally, SWEB's development in 'on-line' computer systems will include the introduction of 'intelligent' work stations, replacing existing VDU terminals. This will enable the terminal to be tailored to meet the specific needs of the individual office user (typist, clerk, manager etc) and will have particular significance in shops. The introduction into shops will provide facilities including a 'point of sale' terminal and a 'viewdata' terminal, as well as giving access to the full range of the board's customer service systems. A working group has recently been established to investigate the two main alternatives in developing terminals in shops:

(*a*) a combined point of sale/viewdata terminal with VDU facilities; and

(*b*) a micro-computer device to provide the facilities specified in (*a*) and the capability to print out receipts, produce work documents etc.

13.33 SWEB is also considering optical fibre network developments. For example the Board is currently considering the introduction of an optical fibre link between the computer centre and the microwave system (as a means of carrying data).

The Electricity Council

13.34 The Electricity Council told us that a paper is currently being prepared which will specify the main requirements for new metering. Agreement will then be sought from the full Council for discussions to take place with meter manufacturers. An EEC grant will be sought to finance part of the manufacturing development. However, there could be no guarantee that all boards, subsequently, would choose the same type of equipment.

13.35 In the Electricity Council's view the introduction of new types of metering would not be delayed because of the need to co-operate with other utilities, especially gas. If necessary the ESI could act independently.

Conclusions

13.36 CALMS is one possible example of the major new technology, particularly for metering and meter-reading, which the boards expect will be introduced on a significant scale. The timing of its introduction is still uncertain. We regard it as important that the ESI should act in unison, both on the ultimate appraisal of such an important investment and in the implementation of the decisions reached as a result of its appraisal. In addition, if the fullest opportunities for increased efficiency are not to be lost, co-operation with other utilities will be necessary.

13.37 The boards' expectations concerning new technology have immediate implications. Firstly, and in general, the prospect of its introduction means that decisions on changes in the revenue collection system should be checked to ensure that they are likely to be cost-effective within the limited time-scale remaining for present methods. Secondly, the new technology will clearly have major implications for metering. Decisions on the replacement of existing meters will need to take fully into account the prospect of the new technology replacing existing meters altogether. Thirdly, considerable reductions in the number of meter-readers may be expected to occur over time. The boards should keep the timing of this change in mind, because of its implications for manpower planning and industrial relations.

13.38 The new technology for metering and meter-reading also has important implications for the use of computers. The argument was put to us that the likelihood of major changes in computing technology make it unproductive to forecast what computer facilities will be appropriate in the 1990s and beyond. But our concern is less for computer hardware and software than for the revenue collection procedures and practices which influence computing needs. Because boards have developed at different speeds and in different ways, a board can say at any particular time that its position in computing is different from that of other boards. If this situation is allowed to continue, the different positions of the boards in future may be a significant impediment to the concerted action which may well be required for the introduction of new metering technology. This possibility is another reason for the industry to consider now how it might achieve greater consistency in practices and procedures.