EXECUTIVE SUMMARY

0.1 PRODUCT DESCRIPTION

0.1.1 Energy meters are used to measure consumption of electricity over a period. They can be classified on the following basis :

- Principle of working
- Type of utility they are installed in
- Accuracy level of the meter
- Type of load (single/poly phase)
- Type of measurement to be made

0.1.2 Construction of an energy meter varies with its end-use and working principle. An induction-type energy meter, the most widely used energy meter for over a century, basically consists of the following four systems :

- Driving system consisting of two electromagnets
- Moving system consisting of an aluminium disc
- Braking system consisting of a permanent magnet
- Registering system consisting of gear train and counter

0.1.3 An induction type electromechanical energy meter works on the principle that when a current carrying conductor is acted on by a magnetic field, the force which it experiences is proportional to the current and the field. An induction type wattmeter consists of an aluminium disc mounted on a spindle, a current coil and a voltage

coil, a permanent magnet and a counter. The current coil is connected in series with the load and the voltage coil connected across the supply. The resultant magnetic force that is developed in the two coils forces the aluminium disc to rotate and the permanent magnet acts as a brake on the disc. The worm and the worm wheel provided with the spindle actuates the counter. Though many changes have taken place in the product design, raw materials used and manufacturing process over the years, the method of operation of an electromechanical meter has not changed since it was conceived by Ferrari in 1884.

0.1.4 The major technological innovation that has taken place in the area is the development of electronic energy meters. These meters are still in the development stage and have been commercialized in the area of industrial/bulk metering only. The static meters developed by Indian manufacturers are still in the prototype stage or in very limited production and the design is therefore still in the evolutionary stage. Design improvements needed are principally in the area of enhancing the 'manufacturability' and reliability of the products. The functional capabilities match those made in other countries. Electronic Meters consist of a circuit wherein instantaneous current and voltage are multiplied in a multiplier (the result being instantaneous power) and then integrated in an integrator to give the total energy consumed.

0.1.5 Though domestic/commercial energy meters account for about 70-80 percent of the total expenditure on energy meters by an SEB, they represent only about 12-15 percent of the total revenue while bulk of the revenue is generated from the industrial users. As a result, both the SEBs as well as the industrial users are very particular about the quality and accuracy level of the meters. Also, with substantial increase in energy consumption per outlet of a domestic connection, SEBs have started giving importance to the accuracy and pilferage features of even domestic meters.

0.1.6 Typically, less than 15% of the meters purchased are used for replacement and the balance 85% are used for new connections, indicating that the average age of a meter installed in the field is more

than 30 years, and that the majority of meters have passed their normal life span.

0.2 INDUSTRY STRUCTURE

0.2.1 There are about 15 large manufacturers of electromechanical energy meters for domestic/commercial use, constituting a total installed capacity of 67 lakh meters per annum. Of these, seven manufacturers also make meters for industrial use. Besides these, there are about 18-20 manufacturers in the small scale sector including two manufacturers of electronic energy meters.

0.2.2 The total demand for energy meters in 1991-92 was approximately 60 lakh meters, of which more than 90% was for electromechanical type energy meter for domestic/commercial use and the rest for meters (both electromechanical and electronic) used for industrial/ bulk metering. About 25 percent of the demand for domestic electromechanical energy meters and almost all the demand for electronic energy meters were catered to by the small scale sector. The average growth rate in the industry over the last 8 years has been 2.4 percent, whereas the same in the last 4 years has been a negative 2.1 percent.

0.2.3 The projected future demand for energy meters based on various estimates comes out to between 65 to 83 lakh meters for the year 1994-95.

0.2.4 Exports of meters have been negligible in the past, while imports in the year 1992-93 amounted to Rs. 169 lakh. These were mainly in respect of meters for industrial use/bulk metering.

0.2.5 A comparative evaluation of the major manufacturers in the organized sector indicates that :

- Most of the organized sector units were started in the early sixties and most of their critical capital equipment is more than 25 years old. The precision of these machines is bound to have

been affected after so many years of use, and as a result, the quality of the product manufactured is also below the required level resulting in high rejection rates.

- Past production of various manufacturers varies a lot from year to year. Therefore, there is no discernible trend in the production figures of various manufacturers.

- Except for a couple of companies, there has been negligible export of energy meters.

0.2.6 Most of the organized sector units are not performing well financially because of the following reasons :

- Industry's overall installed capacity is 50 percent more than the demand; therefore, there is heavy price cutting among manufacturers.

- Reluctance of SEBs to pay a higher price for a better quality meter because of their poor financial condition.

- Steep increase in raw material costs as compared to fixed price agreements that manufacturers have entered into with the SEBs.

According to an organised sector manufacturer, other reasons contributing to unsatisfactory financial position of meter manufacturers are :-

- SEBs inviting tenders and conducting virtual auction after tender opening, with price being the only consideration for order placement.

- SEBs not having reliable data on past performance of meters of different suppliers, resulting in full weightage only to price factor for order placement.

- Unprecedented increase in costs of inputs like magnets, electrical steel etc. in 1987-88 and 1991-92 without adequate compensation in price of finished products.

0.3 INTERNATIONAL SCENARIO

0.3.1 According to an international study, the total market for energy meters in the world is around 40 million pieces with India's share at 5.2 million (13%).

0.3.2 The world market of energy meters is dominated by Schlumberger, Landis & Gyr, ABB (Westinghouse) and Siemens. These manufacturers have manufacturing facilities in various countries and licensing agreements in many others. Till recently, only ABB had a representation in India in the meters area but now reportedly Schlumberger (with Crompton Greaves) and Landis & Gyr (with VXL India) have decided to enter the Indian market.

0.4 TECHNOLOGY GAPS

0.4.1 The major technological gaps between the indigenously manufactured meters and the ones made abroad are :

- poor workmanship, due to use of outdated technology and aged manufacturing facilities used by Indian manufacturers as compared to latest design and technology used abroad.

- quality of few critical raw material/components (jewel bearings, laminations, etc.) available in India does not match international standards.

- Indian specifications are less stringent as compared to the specifications prevailing abroad. Also, the specifications vary from one SEB to the other.

0.4.2 The survey reveals that these technological gaps exist primarily due to the reluctance of SEBs to pay a higher price for a better quality meter, because of their persistently poor financial condition. Moreover, the purchasing procedure in various SEBs is through a single-tier tendering system wherein the lowest bidder is awarded the order.

There is no detailed technical evaluation of the product offered by the bidder. Therefore, there is no incentive for a manufacturer to upgrade the product/technology to international standards.

0.4.3 The R & D focus of various manufacturers in energy metering area has been on the following fronts :

- design modifications and raw material substitution to minimize costs (for domestic meters)
- quality and accuracy improvements (for industrial meters/ bulk meters)
- development of pilfer-proof meters
- development of static energy meters for domestic, commercial and industrial purposes.

0.4.4 Electronic energy meters have gained a strong foothold in the industrial/bulk metering area but are yet to make a mark in the domestic metering sector.

0.5 RECOMMENDATIONS

0.5.1 The technology used throughout the world for energy metering is neither complex nor a closely gaurded secret. As already mentioned, under the current procurement procedure of various SEBs, there is no incentive for a manufacturer to upgrade its product and make an international class meter. But if the following recommendations are implemented, the industry should be able to make world class meters.

0.6 FOR TECHNOLOGY/QUALITY IMPROVEMENTS

0.6.1 Product specifications should be redesigned so that the meter produced is the most cost effective one. The specifications should be designed after conducting the cost-benefit analysis of various

options for each aspect of the specifications. The cost of the meter and specifications go hand in hand.The more stringent the specifications the higher will be the cost of the meter. Besides, the tolerance limits for various input parameters, such as voltage and frequency, should be modified to represent the ones actually prevailing.

0.6.2 The existing manufacturers should either acquire the technology independently or tie-up with a foreign collaborator and promote the high quality product to various SEBs. With such a tie-up, one can also explore the possibility of exporting the meters.

0.6.3 The industry should examine methods by which the price of meters could be reduced further and yet improve technological competence. This could be taken up as an R&D project on a consortium basis by few manufacturers.

0.6.4 Some of the options that can be considered with regard to modifications in the constructional features are :

- Riveting the meter element permanently to the frame with virtual zero tolerance rivets, to eliminate the possibility of shifting the air gap if the meter is dropped or otherwise abused.

- Encapsulation of the potential coil in moulded plastic instead of a heat shrink sleeve to ensure permanent moisture proofing.

0.6.5 Since the raw material required to make a meter for export can now be easily imported at competitive rates, the indigenous manufacturers should now concentrate on the export market. Not ignoring the fact that the Indian specifications are quite different from the ones prevailing in the international market, the meters manufactured in India are the cheapest energy meters in the world.

0.6.6 The manufacturers feel that SEBs should incorporate a two-part tendering system while ordering energy meters. First, there should be a thorough technical evaluation of all the bids submitted, and only those bidders who qualify in the technical bid should be allowed to submit the financial bid.

0.7 FOR OPERATIONAL IMPROVEMENTS

0.7.1 Appropriate pilfer-proof arrangements, including sealing devices and terminal covers, should be designed by various manufacturers and incorporated by the SEBs.

0.7.2 It has been noticed that after the testing and calibration of the meter at the SEB testing laboratory, the meter is not properly handled, and as a result the calibration gets disturbed or the meter stops functioning. Therefore, necessary arrangements should be made for proper packing of the meter, after it is tested and calibrated and till it is installed.

0.7.3 Except for minor changes owing to varying climatic and operational conditions, the specifications followed by various SEBs should remain the same. This would help in the standardization of the product made by various manufacturers, which would result in improved efficiency and consistency.

0.8 METER TESTING

0.8.1 The manufacturers opine that a one-point testing facility should be built up, particularly for static meters, where all the requisite tests can be conducted in a reasonable time-frame. Regional Testing Laboratories should be set up, catering to various SEBs/manufacturers in the region, for speedy and authentic testing of electromechanical energy meters. All regional test laboratories should be preferably under the control of a single authority, they feel.

0.8.2 Meters imported into the country by SEBs/power utilities should be tested according to the relevant Indian standards before installing the same.