

**Goswami**

**Automated Meter Reading (AMR)-Advanced Metering**

**Infrastructure (AMI) IN BEST, MUMBAI, INDIA**

**Introduction :-**

*The Electricity Act, 2003 enacted by the Parliament of India has ushered an era of power reform in India. The philosophy of liberalization, competitiveness and commercial motive is invoked by this act. The AMR with the application of smart meters has the revolutionary potential to contribute significantly in power reform process and to contribute for Consumer Relationship Management (CRM), revenue collection, commercial management distribution system and business process automation apart from AT&C loss reduction.*

**2.0 The BES&T:**

The BEST Undertaking a pioneer utility Company manages the distribution system of island city Mumbai, the financial capital of India have initiated application of AMR technology to achieve efficiency, improve revenue collection, minimize AT&C losses, energy accounting and efficient consumer services. BEST has about 0.9 million Consumers with approximately one million electricity meters out of which 58% are residential consumers, 35% commercial consumers, approximately 5% industrial consumers and remaining street lights, hospitals and other charitable institutional consumers.

Comment:

*3.0 This paper discusses expected gains by application of AMR in BEST in the context of Electricity Reform process and the intelligence of consumer*

energy management infrastructure through smart metering and to achieve customer interest for energy savings and to enhance revenue collection.

4.0 **Regulatory Requirement:**

BEST has regulatory obligation to read consumer meter and issue monthly electricity bills to its consumers giving details of the consumption charges, deposits, taxes and duties etc., for the billing period. The bill has to be on actual consumption giving present and previous meter readings. In case of any lapse on the meter reading / billing, compensation is required to be paid to consumer. Considering the geography of the distribution area with high density of population and limited availability of space / area for meter installation, meter reading is very stressfull activity. AMR is therefore is an effective tool for timely meter reading and issue of the bills.

5.0 **AT&C-Losses:**

The BEST had the ATC losses as per the following figures

| Year    | Average Distribution Loss in % | Year    | Average Distribution Loss in % |
|---------|--------------------------------|---------|--------------------------------|
| 1947    | 10.81                          | 1990-91 | 10.91                          |
| 1950-51 | 9.68                           | 1991-92 | 11.57                          |
| 1955-56 | 8.14                           | 1992-93 | 11.62                          |
| 1960-61 | 9.24                           | 1993-94 | 11.85                          |
| 1965-66 | 7.16                           | 1994-95 | 12.30                          |
| 1970-71 | 7.46                           | 1995-96 | 12.99                          |
| 1975-76 | 9.85                           | 1996-97 | 12.77                          |
| 1979-80 | 9.20                           | 1997-98 | 11.35                          |
| 1980-81 | 10.27                          | 1998-99 | 12.57                          |
| 1981-82 | 9.11                           | 1999-00 | 8.54                           |

|         |       |         |       |
|---------|-------|---------|-------|
| 1982-83 | 9.91  | 2000-01 | 11.01 |
| 1983-84 | 10.59 | 2001-02 | 11.19 |
| 1984-85 | 9.22  | 2002-03 | 11.35 |
| 1985-86 | 9.53  | 2003-04 | 11.11 |
| 1986-87 | 10.59 | 2004-05 | 10.74 |
| 1987-88 | 10.81 | 2005-06 | 12.89 |
| 1988-89 | 9.59  | 2006-07 | 10.78 |
| 1989-90 | 9.96  | 2007-08 | 8.10  |

*Even though, the losses are comparatively lower compared to similar utilities in India, it is the endeavor of BEST to reduce the loss further. It is felt that we can bring down the commercial losses to another 0.5 to 1 % by going for AMR for consumer metering and energy accounting. This would save us a whopping savings of Rs 30 to 50 Cr.*

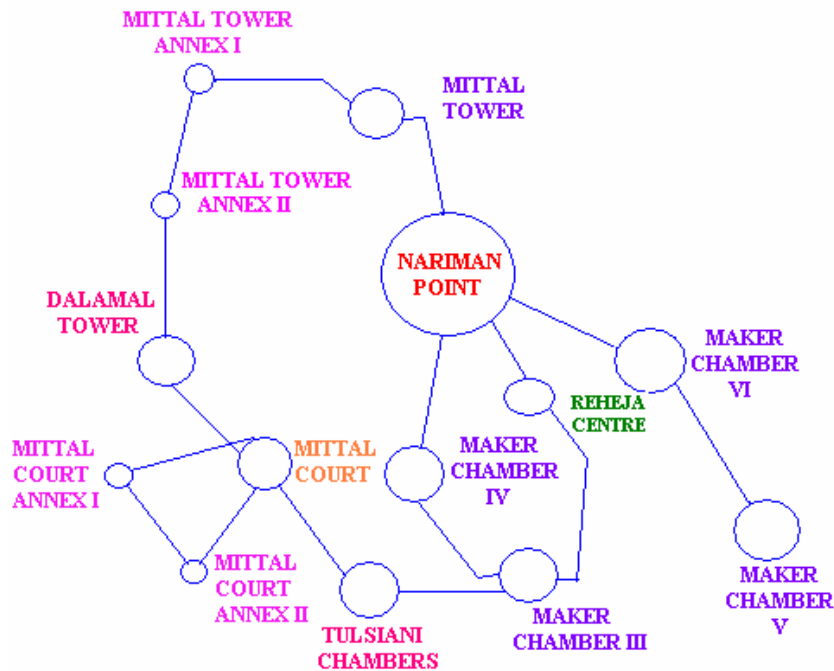
#### **6.0 The communication System:**

*By keeping the above facts, BEST has decided to go for AMR. As we know for the smart meter technology, selection of reliable and cost effective communication medium is most critical, as each meter must securely communicate the information / data to the control room. The entire electrical network of BEST is underground. BEST Undertaking therefore decided to go for dual technology i.e. for PLC & GPRS communication as communication media for the AMR presently being implemented in BEST. The infrastructure tools include hardware and software (meter management software) and customer associated system software. For providing*

*information to the customers, the change in their energy uses, their consumption patterns, peak demand period, off peak demand period prices are recorded. This will allows BEST electric consumers, to participate in price based demand response program apart from power quality and other electricity services issues. This will also fulfill the regulatory demand to implement TOD (Time of the day) tariff system & therefore implementation of the ABT (Availability Based Tariff) regime.*

7.0 **Initial Targeted consumers Area:**

*Even though, BEST have about 9 lac Consumers with an annual earning of about Rs 3000 Crores, About 40% of the revenue comes from about top 8000 consumers. Hence, BEST has initially targeted to install AMR meters to these consumers. In fact we have identified the area of business centre and already installed about 1000 AMR meters with PLCC / GSM communication medium in Nairman Point Area. The network showing these installations is given as under:*



#### 8.0 **Total Target:**

We are also in the process of installation of AMR meters on all our Distribution Transformers (about 2600) and all H V out going feeders in the receiving substations for energy accounting.

#### 9.0 **Implementation details:**

As mentioned earlier BEST has so far installed approximately 1000 meters having 20 Nos of data concentrated routers. The communication medium is taken by GPRS, as well as PLCC (Power line carrier communication) from individual meter to data concentrators. However, the communication medium will be only GPRS from data concentrators to the centralized control room at BEST Head Office. We plan to install total

*approximately 3,000 Nos of AMR concentrator. The details of the project is as under:*

- 9.1 Installation of AMR concentrators for 2860 locations.*
- 9.2 Installation of 72 Nos ABT (Availability Based Tariff) meters.*
- 9.3 Audit meter for 33 KV feeders.*
- 9.4 Installation 919 HT Audit meters with RS 4545 communication port for 11 kv feeders.*
- 9.5 Installation 2676 LT Audit meters for distribution transformers.*
- 9.6 Installation of 8028 CTs for distribution transformer on LT site.*
- 9.7 Integration of GPRS concentrators with PLCC (Power line carrier communication) concentrators. Normally one data concentrator will have data of approximately 500 consumer meters.*
- 9.8 Setting up of control room/data centres equipped with server, internet lines, software & printer section etc. Thus in the initial phase 50,000 consumes shall be covered under AMR.*
- 9.9 The Audit meters has daisy chained meter using RS486 communication port connecting GPRS data concentrator for each voltage level. The data concentrator is having inbuilt MQTD (Message Queuing Telemeter Data Transfer).*
- 9.10 All the feeders and distribution transformer Audit meters are read on daily basis while the consumers meter are read on monthly basis as per the billing cycle.*
- 9.11 The Audit meters of incoming feeders are read 15/30 minutes for the purpose of ABT (Availability Based Tariff) and the consumers meters*

apart from routine monthly readings are read as per the request as and when required.

- 9.12 The PLCC communication is preferred as BEST has got a systematic well maintained underground cable network. The entire distribution system of BEST is underground & the oldest in the country.
- 9.13 The initial phase of the project to be implemented is taken for a purely commercial area Nariman point, which caters to approximately 35 MVA load of commercial consumers, out of the total approximately 850 MVA load of BEST system. Some of the substations where the meters on individual services, distributors and transformers are presently installed are given below.

| <i>Name of the Substation</i> | <i>No. of Router/Data concentrator</i> | <i>Nos of Transformer</i> | <i>Total Capacity In MVA</i> | <i>No of Services</i> | <i>No. of Meters</i> |
|-------------------------------|--|---------------------------|------------------------------|-----------------------|----------------------|
| <i>Mittal Tower Annexe-I</i>  | <i>1</i>                               | <i>1</i>                  | <i>1.6</i>                   | <i>5</i>              | <i>51</i>            |
| <i>Mittal Tower</i>           | <i>1</i>                               | <i>2</i>                  | <i>1.99</i>                  | <i>3</i>              | <i>46</i>            |
| <i>Mittal Tower Annexe-II</i> | <i>1</i>                               | <i>2</i>                  | <i>1.26</i>                  | <i>4</i>              | <i>45</i>            |
| <i>Dalamal Tower</i>          | <i>2</i>                               | <i>3</i>                  | <i>3.225</i>                 | <i>13</i>             | <i>113</i>           |
| <i>Tulsiani Chamber</i>       | <i>2</i>                               | <i>3</i>                  | <i>3.590</i>                 | <i>12</i>             | <i>92</i>            |
| <i>Raheja Centre</i>          | <i>1</i>                               | <i>4</i>                  | <i>5.8</i>                   | <i>16</i>             | <i>57</i>            |
| <i>Maker Chamber-III</i>      | <i>2</i>                               | <i>4</i>                  | <i>3.25</i>                  | <i>12</i>             | <i>36</i>            |
| <i>Maker Chamber-IV</i>       | <i>1</i>                               | <i>3</i>                  | <i>4.2</i>                   | <i>5</i>              | <i>5</i>             |

|                               |               |               |                   |            |            |
|-------------------------------|---------------|---------------|-------------------|------------|------------|
| <i>Maker Chamber-V</i>        | 3             | 3             | 2.99              | 14         | 209        |
| <i>Maker Chamber-VI</i>       | 2             | 3             | 2.995             | 9          | 52         |
| <i>Mittal Court</i>           | 1             | 2             | 1.995             | 8          | 44         |
| <i>Mittal Court Annexe I</i>  | 1             | 2             | 1.260             | 7          | 39         |
| <i>Mittal Court Annexe II</i> | 1             | 2             | 1.260             | 8          | 42         |
| <i>Total</i>                  | <i>19 Nos</i> | <i>34 Nos</i> | <i>36.365 MVA</i> | <i>116</i> | <i>831</i> |

9.14 *As on date 13 Nos of substation consumer are provided with AMR's. These 13 substations are having 34 Nos of transformers having approximately 116/200 services and 800/1000 consumers.*

9.15 *The Routers/Data concentrators taking data through PLCC of these individual consumers and forwarding the same through GPRS communication to the data centre are tested and found to be correct. The billing software testing is presently being done and it is expected that from 1<sup>st</sup> Sept, 2008 these 1000 consumers of 34 transformers will start receiving the bills through AMR system. The central automated software and monitoring system data base with different modules utilized by the BEST's AMR systems is given below:*



**Figure:- Hardware & Software Modules**

#### 10.0 **Conclusion:**

*BEST after implementation of this project has targeted to achieve seamless information flow, faster decision making, faster consumer grievance handling, reduction in time for new connections, achieve energy accounting, reduction of losses, availability of consolidated consumer information, flexible Tariff implementation & total efficient consumer services.*

