

## HT Energy Audit: The Crucial Starting Point for Curbing Revenue Loss

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### **Abstract**

*Though belatedly, the need for reducing excessive transmission and distribution (T&D) losses, in the Indian power sector is now being recognized as one of the key requirements for restoring financial viability of the utilities. Many important actors in the sector are prescribing approaches such as “Total Energy Audit” and “100% Metering” to curb the commercial loss (i.e., power theft) component of excessive T&D losses. Though often not clearly articulated, it is widely believed that most commercial losses occur in the low tension (i.e., 440 / 230 V) grid, and high-tension (i.e., 11 kV and above) grid is considered to be relatively free from the menace of commercial losses.*

*Based on the analysis of the data emerging from the regulatory process in states such as Maharashtra, Andhra Pradesh, Haryana, and Karnataka, this paper points out that, even in the HT sector, commercial losses appear to be significant. Based on this revelation, the paper argues that the starting point in our battle against excessive T&D losses should be to institute an effective energy audit at the HT level. Such an approach is desirable for many reasons that include relatively small requirements of investment and of managerial efforts, high cost-benefit ratio due to higher consumption norm, higher tariff, and small number of consumers in the HT sector. It is also a ‘no-regrets’ strategy, - as the HT audit is an essential pre-requisite for effective implementation of “Total Energy Audit” and “100% Metering” approaches.*

*Further, the paper argues that the regulatory commissions should, after detailed analysis, set time frame for concrete and intermediate milestones for ensuring effective HT energy audit. Once decided, these milestones and timeframe should be strictly adhered to and, in the case of failure on the part of utilities to meet these concrete and implementable targets, strict penalties—such as outright refusal to consider tariff increase proposal—should be levied. Only such unyielding stand by the regulatory commissions would ensure timely completion of effective HT energy audit, which is also crucial for ensuring accountability of utility staff.*

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# HT Energy Audit: The Crucial Starting Point for Curbing Revenue Loss

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## 1. Introduction

For the last two decades, the financial crisis besetting the Indian power sector has been an issue of great concern for the planners and experts. In 1990s, the discussion on this crisis was focused on the large subsidies for agricultural consumers and the rapid growth in agricultural power consumption. It is worth noting that this preoccupation with agricultural tariff and subsidy persisted in spite of efforts on the part of some researchers to point out another crucial causative factor. These researchers had been pointing out that excessive transmission and distribution (T&D) losses, hidden under the garb of agricultural consumption, had been a major cause for the poor financial health of utilities (Roy 1996, Reddy and Sumithra 1997, Dixit and Sant 1997). However, most experts and leaders of the sector continued with their preoccupation with the agricultural subsidy without serious investigation into this crucial factor.

In the last few years, especially after establishment of the independent state electricity regulatory commissions (SERCs), many state utilities are revising their T&D loss estimates from the earlier lower figures of around 18-20% to anything in the range of 35% to 50%. With this, it is now being widely accepted that reduction in T&D losses to a reasonable level is essential for restoring financial viability of the utilities<sup>1</sup>.

However, the belated acceptance of excessive T&D losses has resulted in considerable delay in action to reduce these losses, which is proving extremely costly. Nonetheless, it is a welcome sign that the issue of T&D losses is coming into limelight

now and different approaches are being suggested as prescriptions to address the issue.

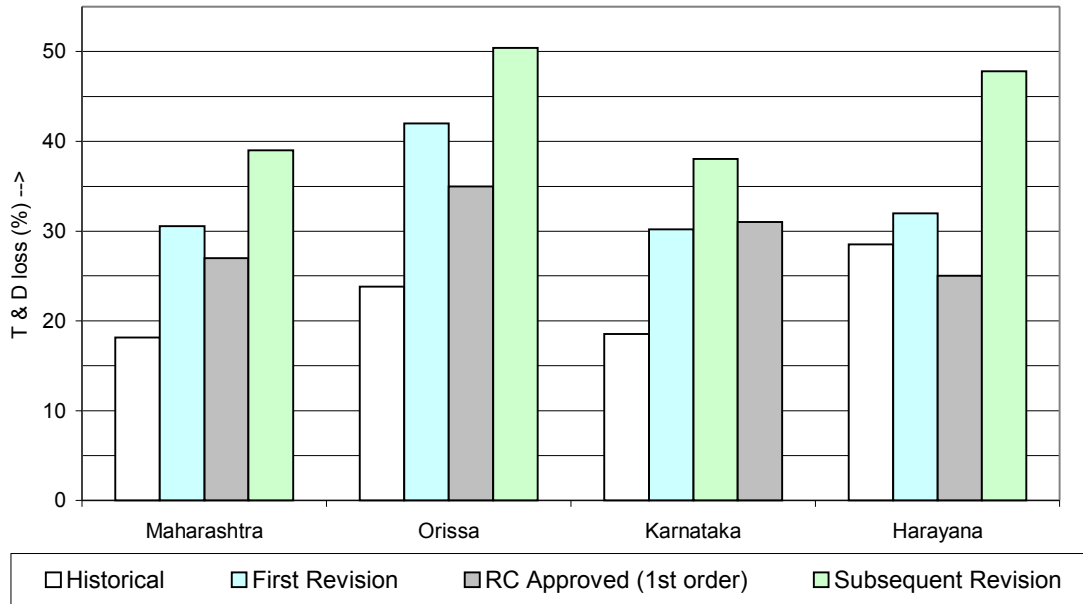
The next section of this paper highlights the large swings that have been occurring in the estimation of T&D losses in various states as well as the prevailing uncertainty in estimation of even transmission losses and HT-level losses. Based on experiences from the states such as Haryana, Maharashtra and Andhra Pradesh, the third section highlights unwillingness on the part of utilities to carry out effective metering even at the HT level. The fourth section points out that commercial losses even at the HT-level might be significant in terms of revenue lost per customer as well as of the total revenue loss. The fifth section discusses various advantages of focusing on HT-level energy audit for increase in utilities revenue. The sixth section argues that the approaches of "100% Metering" and "Total Energy Audit (including LT energy audit)", though essential, would, at best, yield significant benefits only in the long term. The last section presents the conclusions of this analysis.

## 2. Swings in the Estimates of T&D Losses

The first step in the efforts for reducing excessive T&D losses is to properly estimate T&D losses. The next and probably more important step in these efforts is to identify various links or geographical areas in the network that have excessive losses. It is possible that losses in some of these areas or links could be easier to curb as compared to losses in other links/areas. Identification of such links / areas makes it possible to focus initial efforts for reduction

<sup>1</sup> A calculation for Maharashtra's state utility indicates that financial loss due to excessive T&D loss (defined as that above 25%) is about Rs 2,500 crores p.a. And, this is more than the agricultural subsidy that is claimed to be Rs. 2,100 crores p.a. Similar calculations for the other states are likely to reveal the same trend.

**Figure 1: Changing Estimates of T&D Losses**



Source: Tariff Orders of Respective SERCs

Figure 1 highlights changes in the estimated T&D losses in various states. The state utilities have attempted a more realistic estimation of T&D losses during the regulatory process. In states such as Maharashtra and Haryana, the upward revision of loss estimates has been much higher than the RC targeted loss reduction. The bar sequence for Karnataka has been changed as Karnataka utility did two substantial revisions in the loss estimate before the KERC's first tariff order.

in T&D losses on these areas or links. The next two sub-sections demonstrate that, though SERCs and utilities are making efforts to identify such links / areas of high losses, there is still significant uncertainty and differences over the real level of total as well as Transmission and HT losses.

### 2.1 T&D Loss Estimation

Analysis of regulatory orders by SERCs from different states indicate that, even two to three years after establishment of the SERCs and the reforms process, there is still ambiguity over the real level of T&D losses. Figure 1 shows changes in the estimate of T&D losses in the four states.

State after state has revised the figures for T&D losses upward in the last few years.

This has happened in some typical steps. First, as a prelude to the setting up of the SERCs, the state utilities typically increased the loss estimates from the historical low values to a more realistic level. Subsequently, the SERCs ordered reduction in T&D losses, usually by around 5 -7 percentage points. As against this target of lowering T&D losses, the utilities have come back to the SERCs with further revised estimates of losses, which are typically 5 to 10 percentage points more than their earlier estimates. This has resulted in SERCs (as in the case of Maharashtra and Haryana) approving higher loss levels in subsequent orders. The Maharashtra ERC revised approved loss level from 27% to 36%, whereas the Haryana ERC revised approved loss level from 25% to 41%<sup>2</sup>.

<sup>2</sup> Though the MERC order does not explicitly state the approved loss level, it is back calculated based on the loss level projected by MSEB and additional revenue from commercial loss reduction as directed by MERC.

For explaining these upward changes in the T&D loss estimates, the utilities cite some typical reasons such as (a) increased (and hence 'better') sample of agricultural consumers used for estimation of their average hours of consumption and (b) changes in assumed usage level (i.e. load factor) of the un-metered domestic or commercial consumers. Additionally, the utilities have argued that it is impossible to reduce T&D losses to the levels envisaged and desired by the SERCs in a period of four to five years. The state utility in Delhi (viz., Delhi Vidyut Board) has produced evidence of international experience in support of this argument. Some utilities have also argued that, in order to achieve the significant reduction in T&D losses, they will have to police the entire state to curb the rampant power theft. Unfortunately, none of the utilities in the country, whether private or public, has been able to reduce the T&D losses to the level mandated by the SERCs.

## **2.2 Estimation of Transmission and HT Losses**

Measurement or even estimation of T&D loss in the LT (low voltage / tension) system is a difficult task, as the LT network connects millions of small consumers spread across the country and even into remote and inaccessible areas. However, unlike the LT system, the transmission or high-tension (HT, i.e., 11 kV and above) network connects only to a few thousand large consumers. Hence, it is much easier to monitor the HT network. Due to the large volume of electricity flows in the HT network, monitoring and protection systems are already in place in the HT network. For example, at least by design, HT sub-stations are provided with proper metering system to measure feeder-wise incoming and outgoing energy flows.

As a result, one would expect that making correct measurement (or at least estimation) of losses in the HT system would be easier and less prone to large swings.

Unfortunately, most Indian utilities fall short even on this count. Let us review the situation in this regard in the three—considered to be relatively better managed—states of Maharashtra, Karnataka and Andhra Pradesh.

### **Maharashtra**

In its tariff proposal presented before the SERC in March 2000, Maharashtra State Electricity Board (or MSEB) claimed that losses in its Extra HT (EHT) network for the three previous years had been in the range of 3.8 % to 4.2% (MSEB 2000). These estimates were based on the 'load-flow studies' carried out by MSEB. As against this, MSEB, in its tariff proposal submitted in August 2001, claimed that average EHT losses for the preceding six months were 6.7% (starting with 8.4% and coming down to 4.8% in the last month). This implied an upward revision by 2.7 %! (MSEB 2001). This recent estimate seems to be based on the meter readings, but MSEB has not provided estimate of technical losses (i.e., results of load-flow study) for this period.

### **Karnataka**

Karnataka Power Transmission Corporation Limited (KPTCL), the Karnataka utility, had estimated transmission losses for the three consecutive years (1999 to 2001) as 15.6%, 16.47% and 15.17%. Against this, the Karnataka Electricity Regulatory Commission (KERC) pointed out that the studies conducted by two consultants (viz. PRDC, Bangalore and MECON), indicated transmission losses (up to 33 kV) to be around 10% (KERC 2000). The estimates by the consultants were based on load-flow studies and on meter readings, wherever available. Thus, here again, there is a large difference of over 5 percent points in the estimation of just the transmission losses.

### **Andhra Pradesh**

The case of Andhra Pradesh (AP) is more revealing. In the first tariff proposal before the Andhra Pradesh Electricity Regulatory

Commission (APERC), the state utility had claimed the transmission losses to be 4.6%. But, in the second tariff proposal, the utility claimed transmission (up to 132 kV level) loss level to be 8.7%! The utility explained this upward revision in transmission losses by saying that the earlier estimates had been based on load-flow studies, whereas the revised losses were based on actual meter readings. As per the utility's claim, metered data in the period of the four months showed actual transmission losses at the level of 9.6%, and after making certain adjustments for "metering accuracy and meter reading cycle time" etc. the utility estimated the annual loss level to be at 8.7%. During the process of the review of the 'Revenue Requirement', APERC asked the utility to carry out a load-flow study. Surprisingly, the utility was prompt in carrying out the load-flow study and came out with an estimate of technical transmission losses to be 8.7%! (APERC 2001). It is not a surprise, however, that there are serious lacunae in the calculations in the load-flow study submitted by the utility. These are discussed later in Section 4.

To summarize, the above discussion indicates that, even after a few years of regulatory process, accurate estimation of ETH or HT losses is proving to be a difficult task. To overcome this shortcoming, several SERCs have initiated detailed technical studies with the help of external consultants to clearly establish the technical losses at transmission / HT level. As discussed later, estimation of technical losses at the HT level (through load-flow studies) coupled with calculation of actual losses on the basis of energy audit would lead to identification of commercial losses.

### **3. Unwillingness of Utilities for Effective HT Metering**

Realizing the importance of proper energy audit for accurate estimation of T&D losses

and reduction in the same, several SERCs have directed the utilities to undertake "Total Energy Audit" and "100% Metering". But, the emerging evidence clearly demonstrate that the utilities are unable, rather unwilling, to undertake "Energy Audit" or "100% Metering" even at the HT level.

Maharashtra  
Maharashtra Electricity Regulatory Commission (or MERC), in its first tariff order dated 5<sup>th</sup> May 2000, directed MSEB to install the 'Time-of-Day' (or TOD) meters for all industrial HT consumers by September 2000 and for all the remaining HT consumers by December 2000. It also directed MSEB to furnish quarterly reports giving the number of these meters and data obtained from the same. But, even six months after the target date, MSEB was able to provide TOD meters only to half of the approximately 10,000 HT consumers. MSEB's performance has been equally awful in dealing with the task of energy audit of its express feeders<sup>3</sup>. Since 1994-95, MSEB has been claiming that it is carrying out regular energy audit of selected urban areas as well as of the Express Feeders (GoM, 1996). MSEB reiterated this claim in its tariff proposal submitted in March 2000. It repeated this claim again in the proposal submitted in August 2001.

However, this time, MSEB could actually make available the data compiled from energy meters installed on about 220 'Express Feeders' for the period of six months. Out of the total 1320 data points (i.e., 6 months multiplied by 220 feeders), nearly 45% of these data points indicate loss figures that are either less than -0.5% or greater than +5%! (Prayas 2001). This is striking because, usually, the technical losses on such type of feeders should lie in the range of 1% to 2%. This implies that about half of the data points are indicating either ineffective metering, commercial

<sup>3</sup> An express feeder is a HT feeder originating from a sub-station and terminating at one or more HT consumers, i.e., it does not have any LT tapping.



losses, or excessive technical losses. This is a clear indication of MSEB's failure to carry out effective metering even for these 220 'Express Feeders'. It is worthwhile to note that the energy supplied through these 220 'Express Feeders' account for nearly 20% of MSEB's yearly revenue (considering average HT industrial tariff of Rs 4.2/unit).<sup>4</sup>

#### Andhra Pradesh

The case of AP is more serious. In its tariff order dated 27 May 2000, APERC directed the utility to install high-accuracy (i.e., the 0.2% accuracy class) meters at all interface points (where the ownership of power changes from one utility to other, i.e., from either generation to TRANSCO or from TRANSCO to DISCO) and file a compliance report within one month, i.e., by June 2000. Ten months later, in the subsequent tariff order dated 24<sup>th</sup> March 2001, APERC mentioned that the utility could implement this directive only for 3% of the total interface points. Moreover, this order also reported that the utility is demanding another full year to implement the directive! There is no other way to term this delay as ridiculous, when one realizes that, in order to comply with this directive, the utility had to install, in all, only 460 meters.

#### Haryana

The status of HT-level metering seems even more serious in the case of Haryana. Haryana Electricity Regulatory Commission (HERC), in its tariff order dated 26<sup>th</sup> November 1999, categorically mentioned that all interface metering (where the ownership of power changes) should be completed latest by 31<sup>st</sup> March 2000, i.e., within the period of four months. It went to the extent of mentioning that "**.. all metering would be completed by 31 March 2000 for all purposes including transmission and bulk supply tariff application by the licensee. The**

**Commission would not like to be presented again with the plea of non-metering for any purposes whatsoever after 31 March 2000"** (emphasis original).

The utility failed to comply with this directive but went ahead and filed another tariff revision application. In its subsequent tariff order in December 2000, HERC said, "**The Commission reiterates that this work should be given high priority and no slippages beyond the targeted completion date of July 2001 will be allowed"** (emphasis original) (p. 56, para 5.1.2.2). One would expect that the utility would have followed this simple directive at least by the extended target date. But the scene repeated after few months. The subsequent tariff order by HERC dated 6<sup>th</sup> August 2001 (Annex 3) also mentioned that, till the date, the utility had failed to introduce interface meters as directed and has, in fact, requested waiver of this directive! In the case of Haryana, the total number of meters to be installed under this directive was about 300. This failure of utility forced the SERC to estimate transmission losses on the basis of data from other agencies such as regional electricity board and power grid.

To summarize, it is serious that utilities are taking SERCs for granted by not implementing even such simple but crucial directives. Moreover, it goes without saying, that the suggested prescription of T&D loss reduction through '100% Metering' approach would be a non-starter if the utilities are unwilling and / or unable to carry out metering and data-gathering tasks even at the small number of locations, despite the full-knowledge of the high-stakes involved in the energy flowing through these points.

#### **4. Indications of Significant Commercial Losses at HT Level**

The inability, rather unwillingness, of the utilities to install proper metering even at the

<sup>4</sup> Though this revelation of weak metering even for such high-value feeders is shocking, it is essential to note that this revelation became possible due to MSEB's efforts and willingness to make these data public. Such transparency is definitely the first step towards more accountability and reduction in T&D losses.

HT-level raises strong suspicion that all may not be well even at the HT level. Further analyses indicate possibilities of substantial commercial losses even at the HT level.

#### Andhra Pradesh<sup>5</sup>

As mentioned earlier, the transmission losses in AP as per the metered data (for a period of four months) were 9.6% (APERC 2001). The utility applied some corrections and arrived at the estimate of the annual losses of 8.7% based on the meter data. The utility justified this loss-level as the technical losses using a load-flow study. This study found the peak power losses to be 9.66%. The utility then used an assumed figure of 90% for the 'Load Factor' and multiplied the peak power losses with the assumed Load Factor to arrive at the estimate of technical losses as 8.7%. This calculation for technical losses is flawed because the 'Load Factor' (i.e., average load divided by peak load) for the utility was about 70% and not 90%. Using correct load factor indicates technical losses of 6.7% i.e. around 2% less than losses indicated by metered data. The APERC has recently engaged the CPRI (Central Power Research Institute) for estimation of technical transmission losses.

#### Maharashtra

In case of MSEB, indication of the possibility of substantial commercial loss at the HT level emerges from the analysis of the energy audit data of the Express Feeders supplied by MSEB, which is mentioned earlier. Out of the 220 Express Feeders, nearly 40% of the feeders show consistently problematic readings. These include either no reading or the reading showing losses outside the range of (- 0.5%) to (+5 %) for four or more months out of the six-month period! (Prayas 2001). Such a large number

of consistently problematic readings on a very small number of high-stake feeders also points to the possibility of substantial leakage at the HT level.

#### Madhya Pradesh

The tariff proposal put up by Madhya Pradesh Electricity Board (for FY 2001-02) before the SERC clearly mentions that, as per the study carried out by M/s Descon Consultants, commercial losses attributed to the HT industries is estimated at 5.4% (of energy available for sale at the bus-bar). Unfortunately, no details about the methodology or sampling used in this study were available. Table 1 below is reproduced from the MPEB tariff application.

**Table 1 - Estimated Break-up of T&D losses in M.P.**

Energy Input (MU)	27,000
T&D losses (as % Generation)	43.2%
Technical Losses	15.3%
Total Commercial Losses	27.9%
HT Industry	5.4%
LT Industry	6.5%
Household	13.0%
LT Commercial	3.0%
<b>Total Commercial Losses</b>	<b>27.9%</b>

*Source: Consultants study as quoted in MPEB Tariff Application (2001-02) (MPEB 2001)*

To summarize, the recent data coming out in the regulatory process demonstrate that it would not be improper to conclude that, in most utilities, revenue loss due to commercial losses at the HT level would be significant.

<sup>5</sup> After publication of this report an error in our comment in this section about transmission losses in AP was noticed. This is the corrected version. (April 9, 2002)

## 5. HT Energy Audit: Key Starting Requirement

The above two sections clearly demonstrate that: (i) the state utilities are unwilling to establish proper metering even at the HT level, and (ii) there is a strong evidence to indicate that all losses at HT-level may not be technical and may include substantial commercial losses. This needs to be viewed in combination with the facts, that in most states, (i) HT consumption is in the range of 20% - 30% of total sales, and (ii) HT sales account for nearly 50% - 60% of the total revenue. If we take into consideration all these facts it is clear that even a small commercial loss in the HT-section has significant impact on revenue of the utilities. With the HT tariff being twice that of the LT tariff, and the number of HT consumers being less than 0.1% of the LT consumers, it is obvious that the first point of attack has to be the HT sector. As such, the first priority in the efforts towards T&D loss reduction should be to establish an effective metering and audit regime at the HT level to curb revenue loss at this level.

Efforts of reducing commercial losses at the HT level can take different forms; starting from proper vigilance and inspection by utility staff (and /or outside agency) to instituting a rigorous energy audit to identify losses in various feeders. But, depending simply on administrative measures such as vigilance squads has proved to be ineffective in the current utility setup.

More direct measures, which could hold utility and its staff accountable, need to be adopted. Rigorous energy audit is one such measure. Such an audit should aim at establishing the energy balance right from the points of generation / power purchase to points where energy is transformed to LT level. In addition, the audit system should be capable of (i) detecting malpractices on a routine and consistent basis; (ii) being implemented in a time bound manner; and (iii) evolving

concrete and indisputable performance indicators for the utility staff.

The energy balance can be depicted in the equation form as follows:

$$\begin{aligned} \text{Energy Loss (HT level)} &= \\ &\text{Energy generated (net) (A)} \\ &+ \text{Energy Purchased (B)} \\ &- \text{Energy Consumed by HT consumers (C)} \\ &- \text{Energy transformed to LT (i.e. 440 V) (D)} \end{aligned}$$

In the above equation, A and B are metered points and these data are readily available with all utilities. Part D, i.e., energy transformed to LT side is difficult to measure and may involve sizable investment as well as number of metering points. For example, in the case of Maharashtra, accurate measurement of Part D would imply metering of 180,000 distribution transformers (DT) on LT side. This implies an investment of around Rs 150 crore (about 1.5% of utility revenue) for metering. In addition to HT energy audit, this approach will allow us to zoom onto the DT level losses and, hence, would be far effective in localizing high theft points. But its implementation - in terms of installation of meters, proper maintenance, reading, and data analysis in a routine and consistent manner - could take substantial time. Hence, as an intermediate option, some approximations could be considered. These are discussed below.

The first such approximation could be to restrict the audit only up to 33 kV level (i.e., instead of measuring energy transformed to 440 V, energy transformed to 11 kV or 22 kV should be considered). Since energy fed into all the 11 / 22 kV feeders is now measured or expected to be measured soon (as per the MoP's August 2001 report), calculating such an energy balance up to 33 kV is simple. It only involves maintenance and reading of all meters on the 11 / 22 kV feeders (in the substations). In state such as



Maharashtra, this reduces the metering points to around 5,500 outgoing feeders and existing meters of HT consumer. But this would cover over 20% of the total energy fed into the system and 25-30% of revenue.

The 11/22 kV express feeders, i.e., feeders supplying to only HT consumers, could be readily brought into this audit, expanding the coverage a little more.

In the subsequent phase, efforts could be made to include all 11 kV or 22 kV feeders supplying to at least one HT consumer. Tackling these mixed feeders, i.e., feeders supplying to HT consumers as well as having DTs (i.e. 11/22 kV to 440 V) could be somewhat tricky. Depending on the configuration of each such feeder, different options will have to be adopted. Some possible options would include supplying HT consumers through a separate feeder (as was being attempted in some states as part of the system improvement program) or installing check meters for a group of HT consumers. Installing meters on LT side of DTs could be considered, where the number of DTs on the feeder is less.

As a last resort, one could install a check meter for each HT consumer on such mixed feeders. Investment required for such additional metering need not be a deterrent for its implementation. For example, Maharashtra has around 10,000 HT consumers, which give revenue of around Rs. 6,000 crores p.a. Assuming additional metering at all of these 10,000 points (check meters for each consumer) at a cost of Rs. 50,000 per metering point, the one time investment would be Rs. 50 crores. This ONE TIME investment would be less than 0.5% of the utility's yearly revenue (or 1% of HT revenue).

Such check meters can help identify the problematic consumers / areas, where difference in check meter and consumer meter readings falls outside the range

+/- 1% or either of the meter reading is unavailable. This can also become a concrete performance indicator for the staff.

Depending on the state of the HT metering and capabilities of the utility, the manner and the speed of the action-plan may vary. However, there is no barrier to achieving the minimum target of 'Energy Audit' up to the 33 kV in a short time of say, one year. This audit should give an energy balance right from the generation (or power purchase) points up to the HT consumers. Difference in such audited loss figures and the estimated technical losses (based on the load-flow study) could be a concrete indicator of commercial losses.

Such an approach involving tight and complete energy audit at the HT level is desirable for several reasons discussed below.

#### Relative Ease of Implementation

As discussed above, effective energy audit at the HT-level requires installation and reading of only a few thousand meters, unlike the audit of LT system.

#### Low Investment and High Returns

Since HT tariff is significantly higher than LT tariff, reduction in HT commercial losses would be much more valuable. Such high returns coupled with the relatively low-levels of investment and managerial inputs required to institute HT-level energy audit (compared to the LT energy audit or 100% metering approach), imply quicker and higher benefits. This is essential considering the current precarious financial situation of utilities. A 'back-of-the-envelope' calculation for MSEB indicates that HT energy audit can pay back the investment (of around Rs. 50 Cr.) in just half a year, if theft of only 238 MU (= 0.5% of bus bar energy or about 2% of the HT consumption) is curbed.

### A 'No-Regrets' Strategy

Effective metering at the HT level is also essential for implementing 'Total Energy Audit' and theft (identification and) reduction through '100% Metering approach'. This is because at times meters indicating input energy to a division / zone are malfunctioning or readings are misreported, resulting in higher transmission /HT losses and lower losses at division / zone level. To address this issue it is essential to have equal emphasis on correct measurement of transmission and HT losses and reduction in the same. Such HT energy audit is also essential for reforms involving unbundling of utilities or even for implementing concepts such as profit centers in existing SEBs.

Further, if utility is unable to effectively carry out even the HT energy audit - which requires much less managerial and administrative efforts (compared to 'Total Energy Audit' and '100% Metering' approaches) - then the very expectation of T&D loss reduction to a reasonable level will need serious rethinking.

### 6. The "100% Metering" Approach: A Long - Term Solution

The approaches of "100% Metering" and "Total Energy Audit" are essential for achieving several objectives such as: (a) tariff regime based on the principle of "pay as per-use", (b) better targeting of subsidy, (c) identification of some of the 11/ 22 kV mixed feeders that have excessive technical or commercial loss, and, finally (d) establishing accountability up to the level of linesmen of the utility. Hence, it is inescapable to carry out the "Total Energy Audit" as well as '100% Metering'.

But, it needs to be considered that this requires not only large investments but also immense efforts involved in installation and regular reading of millions of meters (in each state) as well as in billing equally large number of consumers. In the case of

millions of "single bulb houses", innovative approaches such as load limiters and efficient bulbs would be far more prudent than blanket metering in the medium term.

The second consideration in making effective use of '100% Metering' relates to the billing systems of SEBs. Many utilities are yet to install the system of computerized billing and systematic numbering of each consumer (linking the consumer to a pole / DT or a feeder). Further, well-designed software to capture and analyse these data will have to be put in place and used by a large number of sub-division level staff!

Another aspect relates to integrity of the audit. Unless the billed energy is traced back to the supplied energy up to the point at which energy is fed into the system, the utility of the whole exercise could be greatly reduced. The whole exercise can be rendered ineffective by tampering (or making dysfunctional or not reading) just a few key meters.

These will certainly act as major hurdles in implementing and effective use of '100% Metering' towards the goal of complete LT-level energy audit.

Before we commit to '100% Metering' as the sole answer, it is worth doing a reality check. Metering and billing performance of utilities is not very encouraging even in the case of categories of customers that already fall in the "100% metered" bracket (e.g., domestic, commercial, and industrial). In Orissa, most of the LT consumption is not metered. In UP, consumption of 44% of metered consumers (that include domestic, commercial, and even small industrial consumers) is "assessed" and not measured. During the first tariff hearing of MSEB, it was revealed that about half of the bills issued to residential and commercial consumers were not based on metered consumption despite these consumers had been metered since the time of connection.

Considering these factors, despite large investment and immense efforts, approaches of “100% Metering” and “Total Energy Audit” are unlikely to yield significant results in most states within a time frame of three to five years. Hence, we cannot ignore the HT audit and it has to be treated as the starting point for proper identification of high loss area, for curbing theft and more importantly the revenue loss.

## 7. Conclusion

The emphasis by SERCs and the Ministry of Power on reduction of excessive T&D losses is a welcome development.

Considering that many power utilities are almost bankrupt, it is essential to give higher priority to measures that can lead to increased revenue within a short time, with limited investments, and with limited managerial efforts. This understanding coupled with the recent evidence of poor HT-level metering and possibilities of significant commercial losses at the HT level, necessitates that the approach of stringent HT-level energy audit be made the foremost priority. This crucial as well as urgent measure should not be put on the backburner in our zeal to ensure “100% Metering” and “Total Energy Audit” at the LT-level.

Many SERCs have directed utilities to undertake HT energy audit in successive tariff orders. Considering the importance and relative ease of HT-level energy audit, the SERCs need to be far stricter in dealing with the failures of utilities in complying with their directives in this regard. This is essential for maintaining the sanctity of the directives by SERCs. For example, the SERCs should direct utilities to institute effective HT-level energy audit within a reasonable period and should reject any tariff proposal after that period, if it is not accompanied with proper results of the

HT-level energy audit. Unless the SERCs adopt such unyielding stand on implementation of such crucial, urgent, and relatively ‘easy-to-implement’ measures, the entire regulatory process would soon be rendered ineffective. On the other hand, such unyielding stand on the part of SERCs would also create pressure on the utility’s top brass to make those responsible for HT energy audit more accountable. SERCs should also direct utilities to publish results of such energy audit (along with names of concerned officers) through newspapers as well as on the Internet so as to facilitate public scrutiny of utility’s performance.

In order to facilitate HT energy audit and to overcome the financial difficulties associated with procurement of meters, the SERCs may choose to charge a special component in tariff, which should be devoted exclusively to meeting expenses relating to the HT-level energy audit. Consumers should be willing to share this small additional burden (of the order of 1 or 2 paise per unit) to ensure that utility is made accountable. Such an approach would also help in ensuring more stringent public scrutiny of performance of utilities on this account.

Simply carrying out stringent HT level energy audit and curbing HT theft would, by no means, be sufficient to make utilities financially viable. Reduction of high technical losses, LT level theft, and other efficiency improvement measures are also essential. But curbing HT theft with iron hand would, on one hand, give the utilities much needed cash and, on the other hand, would give a clear signal to corrupt utility staff and consumers that the party is over. Such a signal is also critical for the success of measures such as “Total Energy Audit” and “100% Metering”.

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