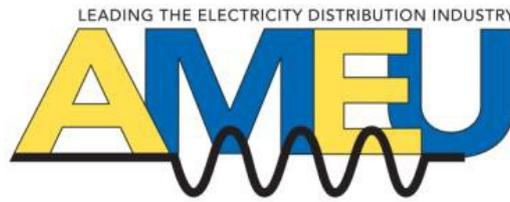


# The Indian DRUM Project – Distribution, Review, Upgradation and Management

Subtitle: “Beware the man wearing a suit”



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## 1. Introduction

The idea for this paper has come about from:

- the AMEU 62<sup>nd</sup> Convention in Stellenbosch last year (2010) where yet another paper was presented by a visitor from the “developed world”, Mark Damm of the US, on Management Practices of Distribution Utilities.<sup>1</sup>
- the eleven AMEU Convention and Technical meetings since the year 2000, the year the REDs Blueprint was produced by UK consultants and lawyers under the auspices of the then Dept of Minerals and Energy at which we have witnessed 22 similar papers from various European and South African authors (Refer Appendix 1).
- The authors participation in both the Dept of Minerals and Energy and Dept of Energy Ministerial Summits on Distribution Maintenance of 2003 and 2008, neither of which have led to anything obviously meaningful.<sup>2</sup> and what put this all in context,
- the words of Jan Coetzee Drakenstein (Paarl) Municipality, in accepting his Honorary Member Award at the 2010 Stellenbosch Convention.

**“When working as a young apprentice out in the field my foreman said to me, be careful when the man in the suit comes, he always ‘boggers it up’ “**

Which gave rise to the question “what real message are we leaving with members as they return home after each convention?” “How they can confidently improve and secure their undertakings?” Undertakings where many have to contend with the realities of under investment in infrastructure replacement and upgrading, dwindling numbers of experienced staff, falling quality of supply, a consumer base that includes a large proportion of poorer people, significant technical losses, that wonderful euphemism for “theft”, and consumer non-payment issues. Conditions which do not prevail in any of the countries from which the management practices preached over the last 11 years prevail – a variation of the “men in suits” that Jan Coetzee’s foreman had cautioned him about.

We set ourselves the objective of finding practices that we could draw on from a country where conditions more similar to South Africa prevail. Having recently become part of a large UK based consultancy

practice with operations world-wide, we hoped that somewhere amongst these world-wide operations we would find experience in conditions more similar to South Africa. We have, the Indian practice of our Consulting Group, Mott MacDonald Pvt Ltd, India, and their involvement in the Indian DRUM project.

This paper presents an initiative in India undertaken to improve their Distribution services in conditions not dissimilar, probably worse, to that currently prevailing in South Africa. In doing so we also identify “road signs” or pointers for our own Electricity Supply Industry and the distribution undertakings that form a major part of it.

As principal authors, we had little prior knowledge of the Indian electricity supply industry and we have not attempted to research it extensively. We have limited our research to the DRUM project working from papers and comments from our co-authors and other contacts who participated in the DRUM project. In the latter regard we particularly acknowledge the input and assistance we received from Vinod Shrivistava of Core International, Washington DC, whose practice and Indian office played a significant part in initiating the DRUM project. The information and statistics we have assembled and presented are merely to put the Indian electricity supply industry in context against the South African Industry that we are all familiar with.

Our full acknowledgements are recorded in Section 10 at the end of this paper as well as in the footnotes.

## 2. India and its Electricity Supply Industry

The information presented in this section is merely to put the Indian electricity supply industry in context against the South African Industry that we are familiar with. Some of the information is anecdotal and we have not attempted to verify its accuracy or absolute correctness. To put into a South African context the South African data is given in brackets.

The 2010 GDP of India was US\$ 1 530 billion (SA US\$ 357 billion, 1/6<sup>th</sup> of India) whereas the GDP per Capita was US\$ 1 265 (SA \$ 7 185 i.e. 5,7 times that of India)<sup>3</sup>

37% of the population of India are living below the poverty line (SA 50%)<sup>4</sup>

The population of India is 1,2 billion (SA 50 million) The national annual Maximum Demand of electrical power is 200 GW (SA 35 GW) Per capita the usage of electricity in India is only 0,16 kW of MD (SA 0.7 kW of MD). South Africa’s electrical power usage is thus 4,2 times greater than that of India on a per capita basis.

Electricity generation has been largely the domain of the public sector. In 2007 electricity **demand exceeded generation** capacity by 15% and power outages of hours, even days are still common. A new Electricity Act in 2003 introduced far-reaching policy changes, including mandating the separation of generation, transmission and distribution aspects of electricity, abolishing licensing requirements in generation and opening up the sector to private players, thereby paving the way for creating competitive market-based electricity. In comparison South Africa is aiming to introduce with its current new generation regulations. Policies similar to what prevailed in India prior to 2003; India’s first endeavour to develop adequate generation capacity with private investment, a policy which proved a failure.<sup>5</sup>

In the year 2003 prior to the DRUM project commencing implementation, only 60% of the Indian population had access to electricity (SA 83% in 2011<sup>6</sup>) and 30% of India’s villages remained un-electrified.

The energy supplied but not paid for, or not known due to theft by meter tampering, illegal connections and/or faulty/incorrect metering, before the DRUM project commenced was nationally as a whole in excess of 40%, standing at 53% for the 3 DRUM pilot sites. (Compared with the “non-technical losses” in SA of 15%, estimated<sup>7</sup>)

As a political policy India supplies electricity at no cost (“free electricity” – at least to the user) to selected groups of the population, principally in the agricultural sector (small farmers who are dependent on pumping water and make up a large proportion on the economic activity of the country). The policy of this “free electricity” has come to be recognised as a factor as to the poor quality of supply and condition of

the networks in India. **The first road sign for South Africa with our political policy of “free electricity” for sectors of our population.**

India has 42 Distribution Undertakings most of which are public sector organisations, “State Electricity Boards”. They are generally aligned to the individual states in India with one or more undertakings per state. There are a limited number of undertakings which are purely focused on urban distribution, for example in New Delhi and Calcutta. Refer triangles in map of Figure 1.

**Figure 1: Indian Distribution Undertakings.**<sup>8</sup>



The state of Maharashtra is of note. It includes the city of Mumbai, one of the biggest urban conurbation in India. It has a single state undertaking supplying both the massive urban conurbation as well as other towns and a very large rural area (the farmers pumping water). The anecdotal comment of this combined large urban and rural set up is that it is far from ideal and indeed “is a mess” **Another, possibly now redundant, road sign for South Africa with our late strategy of converting the total national distribution into 6 Regional Electricity Distributors (REDs) each of which would have covered both city urban conurbations as well as extensive rural areas.**

A very few of the undertakings have been privatised, a notable case being New Delhi, where the undertaking was split into two at the same time. Privatisation is not regarded as having been a success in India by some informed commentators on the industry, with corporatisation being considered a better option. Opinions on this however do differ.

It has not been possible to get meaningful statistics on the staffing levels of the electricity undertakings as many form part of a combined state utility covering all service and infrastructure sectors, e.g. water, in addition to the electricity service. The informed view is that with a few exceptions the undertakings are very much overstaffed. The DRUM reports referred to by the authors record that the Maharashtra State Electricity Distribution Company Ltd (MSEDCL) has an employee complement of 100,000<sup>9</sup>. This is the utility company for the state that includes the conurbation of Mumbai referred to above. The Company also includes an own generation capacity of 10, 000 MW. By comparison Eskom in South Africa has a staff of 35,000 (Generation, Transmission and Distribution) with a maximum demand of 36,000 MW

The overstaffing is attributed to the fact that the undertakings are under the control of state politicians who used the utilities to further political strategies of increasing employment levels as well as satisfy political patronage objectives. The informed view is that this practice together with low spending on the infrastructure has contributed significantly to the malaise that lead to the poor performance of the electricity distribution sector. **Another road sign for South Africa with such practices are becoming increasingly familiar.**

An interesting factor influencing the quality of supply

A description of the North Delhi Power Ltd (NDPL) undertaking prior to 2003 summarises the situation in the Indian distribution. The utility had frequent power outages, poor consumer relations, lack of maintenance, obsolete equipment, limited training, lethargic employees, transmission and distribution losses of 53%, 32% due to theft, and was considered bankrupt<sup>10</sup>.

### **3. The DRUM Project – General background and introduction.**

The DRUM project, interestingly in the context of our premise for embarking on this paper and what we sought to avoid, was conceived by the United States Agency for International Development, **USAID**.

The hypothesis behind the DRUM project is that reforming the distribution sector, that closest to the consumer, is an essential first step to reforming the rest of the POWER sector and crucial to increasing the attractiveness of the sector to private investors. It was recognised that Distribution is the most critical segment of the electricity supply chain, yet when the Electricity Act of 2003 was enacted in India the distribution sector was in such disarray that the few attempts at privatisation failed and interest from the private sector was weak. Leading to a recognition that unless the distribution sector was viable and could reliably deliver to the consumer, investors would not be interested in either the Distribution sector **or the Generation sector**. Why invest in production when you cannot deliver?

There is a very significant message in this for us in South Africa with our Government's initiatives to attract privately funded generation, the IPP's. An initiative driven partly by the belief that if tariff increases are to be restrained in the future, then new generation capacity must be privately funded rather than developed by the State company Eskom. The message extends to our Distribution sector as well. The huge sums of money estimated to be needed to upgrade and replace the aging distribution networks will undoubtedly need massive private funding.

Indeed our concern and that of informed colleagues in the industry is that with the generation capacity shortages that arose subsequent to the Dept of Minerals and Energy Ministerial Summits on Distribution Maintenance of 2003, its objectives were totally overshadowed and then forgotten by the "blame game" and focus that arose on restoring generation capacity to achieve acceptable reserve margin. When the generation capacity is restored to adequate levels the nation could be surprised to find that the distribution network is incapable of reliably delivering the new capacity. This is partly what lead to the second Summit in 2008.

The DRUM project sought to intervene in this dilemma facing the implementation of the 2003 Electricity Act. It is based on 3 focus areas.

The **first focus area** was showcasing **replicable models** of commercially viable electricity distribution with supporting institutional structures.

In terms of the showcasing and the strategy of replication only three state utilities were targeted and pilot projects were instigated at a subdivision of each of these. The state utilities were:

- the Bangalore Electricity Supply Company (BESCOM)
- the Maharashtra State Electricity Distribution Company Ltd (MSEDCL)<sup>11</sup> and
- the Madhya Gujarat Vij company Ltd (MGVCL)

The **second focus area** was Functional Training for personnel in all distribution undertakings nation wide and at all personnel levels, top (management), middle and low.

The **third focus area** was an exchange programme between two of the target utilities, Bangalore – BESCO and Maharashtra (MSEDCL) and the US Department of Agriculture’s Rural Utility Service (RUS). The latter being an indication of the significant agricultural consumer base of the Indian economy.

The North Delhi Power Ltd, which became a Public- Private joint venture between TATA and the Delhi Government in 2003 was an original target utility for DRUM but they chose to undertake the technical reforms on their own. They however made good use of the DRUM Functional Training at their own cost for both technical and non-technical capacity building reform.

**Fig 2 – Map - Location of target pilot projects** <sup>12</sup>



These focus areas were implemented by the following organisations or service providers.

- i) Pilot projects: Tetra Tech, known as PA Government Services at the time the DRUM project formally commenced, part of PA Consulting Group.
- ii) Functional Training: CORE International of Washington DC and India
- iii) Exchange Programme: US Department of Agriculture’s Rural Utility Service (RUS)

The co-authors to this paper Sadiq Shafiq and Veena Gupta were part of the ‘Premier Mott MacDonald’ team who, along with KPMG, assisted the PA Consulting Group/Tetra Tech on the pilot projects for the Maharashtra State Electricity Distribution Company Ltd (MSEDCL).

The particular sub-division of MSEDCL was the” Aurangabad circle”, Urban Divisions I and II.

The programme duration of the three focus areas are:

- Pilot projects: 2004 to April 2011.
- Functional Training: 2004 to September 2012, and
- Exchange visits: 2004 to September 2011.

## 4. Functional Training

A major component of DRUM was dedicated to building capacity of personnel in all the distribution undertakings of India as a whole.

The two major components of the DRUM Training Programme was to:

- Enhance the knowledge and experience of a significant number of distribution engineers, managers and technicians, the original target being 25 000. This was to be achieved through the facilitation of technical and managerial training delivered by professional Indian training institutions: and as a consequence
- Support the development and institutional capacity enhancement of selected Indian educational institutions for sustainable delivery of distribution business management, reform and regulatory training.

CORE International were responsible for developing the training material. The Indian Ministry of Power working through its finance agency, the Power Finance Corporation (PFC), chose 20 training institutions, a mixture of public and private institutions, which would deliver the DRUM training. A DRUM secretariat was set up which was responsible to USAID, the Ministry and PFC for the day-to-day coordination and management of the training. The PFC was responsible for reimbursing the training institutions on behalf of USAID.

The focus of the training is to reach both the grass-root level of staff; management as well as State Regulatory Commission staff. The target groups for training are:

- Utility Senior Management
- Utility Middle Management
- Utility Junior Management
- Utility Technicians and
- Other Stakeholders

Refer Appendix 3 for a more detailed breakdown.

19 Courses were developed broken down into 3 principal themes being:

- **Technical**  
Best practices in Distributions Systems Operation and Maintenance  
GIS-Support Network Planning, Analysis and Asset Management  
Distribution Loss Reduction  
Distribution Efficiency and Demand Side Management (DSM)  
Best Practice for Agricultural Pump Sets (Rural DSM)  
Electrical Safety Procedures, Accident Prevention and Disaster Management
- **Management**  
Performance Benchmarking and Quality of Supply and Service  
Customer Satisfaction, Communications and Outreach  
Distribution Business Management and IT-based Solutions  
Regulation of Distribution Business  
Change Management in Power Distribution  
Rural Power Supply and Participatory Models
- **Support**  
Project Development and Detailed Project Reporting  
Communications Skills, Employee Motivation and Morale Development.

The Functional Training/Capacity Building has proved to be the most successful component of the DRUM project.

The initial target number of 25 000 has been well exceeded and the programme is on track to have trained 35 000 people by the end of the training component of the DRUM project, September 2012.

As of January 2011

- 33 000 have completed short-term training (3 to 5 days)

- 150 have completed long term (1 year) executive management training, and
- 1 600 have completed a comprehensive distance-learning programme.

The programme has succeeded in establishing a culture of training, certainly within the 3 utilities targeted for the pilot projects, but to a lesser extent in the other distribution undertakings throughout India. A measure of the success is the willingness of the undertakings to continue to send employees for DRUM training even after the USAID financial support terminates.

The training programme undertaken by the North Delhi Power Ltd (NDPL) undertaking using the DRUM material and concept, particularly those falling under the financing and billing themes, highlighted an interesting aspect of Indian demographics and possibly the difference between the State undertakings and the Public Private Partnership of NDPL. These courses brought the benefit of training more women, with the NDPL finance staff complement being 1/3 women. In stark contrast with the DRUM pilot undertakings where very few women are employed and very few have been trained.

The major lessons (gaps) learnt from the programme have been:

- Mechanisms to be established for determining the level of learning (pre- and post- tests) and
- A procedure to be in place to follow-up with trainees the effectiveness of the training (on a sample basis)

**The road signs/lessons for South Africa identified from the DRUM Functional Training component:**

- **Training and development is a key element in the development and upgrading of the distribution undertakings and can be successfully set up and delivered using outside agencies.**
- **Rather than creating you own in house training institutions, develop the educational institutions that are in place. (Especially relevant with the situation we have in South Africa of limited manpower resources in the educational, indeed most technical fields.)**
- **The customer and customer interface are part of the business and need equal training experiences.**

The DRUM training experience reinforces a plea made at the South African Ministerial Distribution Maintenance Summits in 2003 and 2008. We need to bring back apprenticeships to maintain standards and quality of supply.

The Functional Training concept also aligns well with the recently announce National Treasury Internship Programme for the Energy & Water Sectors of Municipalities in South Africa.

## **5. Exchange programme**

The exchange programme although established as the third stand alone focus area of the overall DRUM project in effect was an extension of the capacity building focus of the more formal functional training component.

An early objective of the DRUM programme was to provide a national strategy and alternative financing for electric utilities utilizing the experience of the Rural Utility Service (RUS) of the US Department of Agriculture. To provide technical assistance based on the US rural electric utility experience to plan, design, finance and implement distribution reform and rural electrification programmes. The Indian counterpart to RUS, the Rural Electrification Corporation (REC) stopped participating early on in this programme.

The focus of this component then shifted from finance to best practice training through a partnership between Indian electric distribution companies and US electric cooperative groups. This included exchange programmes, study trips, workshops, expert discussions and training programmes with participation from both sides. Indian managers, engineers and linesman were trained on best practices at the US electric cooperatives. Likewise experts from the US visited the Bangalore Electricity Supply Company (BESCOM) and Maharashtra State Electricity Distribution Company Ltd (MSEDCL) to exchange ideas and working procedures and to share experiences.

The success and real impact of this component have been difficult to assess. The reports indicate that the success of the exchanges varied between the three pilot utilities. They were probably dependent on the

commitment and enthusiasm of the top management and the experts of the participating utilities on both sides. That support for the continuation of Exchanges seems to come mainly from Executives who have participated in exchange programmes can be interpreted in both a negative or positive light in terms of the benefits. There is the element of the undoubted benefits of networking in this.

That the objectives of this component changed during the formulation of the programme and a key Indian party, REC, withdrew are indicators that exchange was a difficult programme to focus and manage. The fact that by its very nature it is less formal contributes to these difficulties.

The Bangalore Electricity Supply Company (BESCOM) and Maharashtra State Electricity Distribution Company Ltd (MSEDCL) report very positively as to the benefit to them of the exchanges and both will be continuing with the programme at their own cost after DRUM formally comes to an end.

In terms of the universally accepted recognition that “change must come from the top” the major but intangible benefit of the exchange programme may be the one way that reform from the top can be encouraged.

**The road sign for South Africa is that exchange programmes are worthy of consideration, but need careful planning and management to achieve the best benefit.**

## 6. Pilot Projects

Pilot projects are the only part of the DRUM project that was specifically focused on the three targeted state undertakings. They are also the most complex and extensive part of the project.

To report completely and in meaningful detail on the full scope of the projects is beyond the objective of this paper. We have therefore limited the comments to some of the principals that went with the projects and treat the physical scope at a high level.

We have also limited the specific scope to the utility with which the co-authors in the ‘Premier Mott MacDonald’ team were involved, namely the Aurangabad circle, Urban Divisions I and II of Maharashtra State Electricity Distribution Company Ltd (MSEDCL). In terms of the fundamental membership of the AMEU this also has relevance as it was the only undertaking of the three that is predominantly urban.

The objectives of the pilot projects was to demonstrate best commercial and technological practices that improve the quality and reliability of the “last mile” power distribution in both urban and rural distribution undertakings.

The Tables 1 and 2 briefly describe in electrical power terms the business of the Aurangabad circle undertaking. This reflects the predominantly urban characteristic of the undertaking. The un-metered agricultural supplies, a consequence of the free electricity policy for this area is to be noted.

**Table 1  
Number of Customers Aurangabad Divisions 1 and 2**

Category	Total Consumers	Metered	Un-metered
Residential & Commercial	166,323	166,323	0
Industrial Power	3,560	3,560	0
Public Water Works	73	73	0
<b>Agricultural</b>	1,969	71	<b>1,898</b>
Street Light	738	738	0
High Tension	433	433	0
Other	12	12	0
<b>TOTAL</b>	<b>173,108</b>	<b>171,207</b>	<b>1,898</b>

**Table 2**  
**Operating and Financial Statistics Aurangabad Division - 1**

Aspect	Quantity	Unit
Consumers		
EHV (132kV)	3	No.
MV (33/11kV)	273	No.
LV:		
Domestic	57,414	No.
Commercial	8,931	No.
Industrial	1,860	No.
Agricultural	1,417	No.
Water Works	39	No.
TOTAL	69,937	No.
Power Lines		
33kV	82/9	km/No. Feeders
11kV	260/40	km/No. Feeders
LV	807	Km
Distribution Transformers	762	No.
Substations		
400/220 kV	1	No.
220/132 kV	1	No.
132/33 kV	2	No.
33/11 kV	6	No.
Energy per annum	740	MWh
Energy Collections per annum	460	MWh

## 6.1. Pilot Project Principles

The pilot project practices were expected to satisfy the following basic principles

- Commercial viability.  
Factors to be considered being, amongst others
  - Safety
  - Minimize cost of ownership over life cycle of project
  - Customer satisfaction and
  - Protection of assets
- Reproducible  
The practice/process to be reproducible in other Divisions of State Distribution Company (MSEDCL).
- Scalable  
The practice/process to be able to be scaled up in size from the Aurangabad Division to all of the State Distribution company and to other utilities.
- Breakthrough Projects.  
Identify and establish projects that are pioneering steps forward in the development of the State Distribution Company.

The starting point of the process is a 'best practice document' and the project kicks off with a Detailed Project Report (DPR) Under DRUM the process began with a generic best practice document<sup>13</sup> which was customised to a DRUM generic best practices document which was to be the State Distribution Company (MSEDCL) best practice document<sup>14</sup> A gap analysis was then conducted against each best practice to compare the 'as is' condition to the desired best practice. From this flows the DPR report which addresses the desired best practice, 'as is' condition, the gap, the project proposed to bridge the gap, the costs, the benefits, the procurement plan, the risks identified with going forward with the proposed project and how these risks will be minimised.

The DPR then becomes the vehicle for requesting funding from USAID and Power Finance Corporation (PFC) of the Indian Ministry of Power.

Key Performance Indicators (KPI) and Key Key Performance Indicators KKPI form an important part of the DRUM pilot project process. The KKPI's for Aurangabad Urban Division 1 are given in Table 3.

**Table 3: Key Key Performance Indicators for Aurangabad**

Sr No	Parameter	Unit of Measurement	Target	Base Line July 2005
<b>Availability</b>				
1	<b>SAIDI</b>	Hours	<b>2</b>	<b>39</b>
2	<b>TXR Failures</b>	Percentage	<b>Nil</b>	<b>11.07</b>
3	<b>CAIDI</b>	Minutes per Occasion	<b>90</b>	<b>19</b>
4	<b>Overhead Line failure rate</b>	Faults per 100 ckt-km of 11 kV Overhead Line	<b>2</b>	<b>355</b>
<b>Reliability</b>				
5	<b>SAIFI</b>	Nos	<b>1.3</b>	<b>126</b>
<b>Cost</b>				
6	<b>End to End Efficiency</b>	Percentage		
7	<b>AT&amp;C Losses - Aggregate Technical and commercial Losses</b>	Percentage	<b>8</b>	<b>52.46</b>
8	<b>Return on Capital Equity (ROCE)</b>	Percentage	<b>10</b>	
9	<b>O&amp;M (Revenue Expenses) per unit Energy Input.</b>	Paise per Unit	<b>10</b>	
	<b>Collections (as bank deposits) compared to energy received from Transco.</b>	Percentage		<b>47.54</b>
<b>Customer Service</b>				
10	<b>Customer Satisfaction Index</b> (% of customers somewhat or very satisfied)	Percentage	<b>100</b>	<b>46</b>
11	<b>No of voltage complaints received during the month</b>	Nos	<b>0</b>	
12	<b>% of New Service Conn. Effected within 3 days</b>	Percentage	<b>100</b>	
13	<b>% of Billing complaints resolved within Regulatory time limits</b>	Percentage	<b>100</b>	
14	<b>% of Supply Complaints resoved within 2 hours</b>	Percentage	<b>100</b>	
15	<b>% of employees having being trained on ytd basis</b>	Percentage	<b>100</b>	<b>12</b>

Some items of note in the indicators at the base line date of 2005:

- The high transformer failure rate (11%) which seems to have been endemic in the Indian distribution utilities.
- The high technical and commercial losses: 52,46%.
- The low proportion of 'Collections' compared to energy imported: 47,54%

## 6.2. Specific Technical Upgrades

- Network refurbishment, including installation of capacitor banks, which improved voltage, reduced line losses, and increased line efficiency.
- Construction of new sub-stations and refurbishment of old, which improved the system reliability and availability, while allowing for system growth.
- Provision of Land for the new substations, which was a difficult and costly project, as land in Aurangabad, an urban centre, is limited and the "not in my backyard" syndrome was widespread.
- Replacement of 48,000 (target 52,000) single-phase household and commercial meters and 2,500 three-phase for large industrial customers. The new meters are static electronic meters (rather than the old electromagnetic meters which are less accurate and prone to theft). The new meters were placed in tamper proof boxes.

As a result of the installation of the new meters, system losses were reduced from 29.9% to 18.41%, with a monthly savings of 93,951 kWh and a monthly savings of nearly US\$9,000. With these savings, the payback time is estimated to be about 11 months.

- Breakthrough Projects: The special projects meant to demonstrate new technology. They include:
  - IT infrastructure development,
  - installation of polymeric surge protectors,
  - installation of fault passage indicators (which allow linemen to tell exactly where the fault has occurred),
  - initiation of load survey and quality of power indicators.
- Installation of a High Voltage Distribution System(HVDS), which
  - reduced electricity theft, illegal hook-ups do not work with high voltage systems as there is no transformer to bring the voltage down to usable levels
  - reduced system faults,
  - provided for easy upgrades in the system,
  - improved reliability (only a few consumers are connected to a transformer so an outage in one area did not effect other areas, and
  - increased system capacity with electricity losses being reduced significantly.

**One key informant noted that this HVDS upgrade was the "greatest achievement of DRUM."**

## 7. Financial

Financial issues, as in so many endeavours are ultimately at the heart of distribution reform and system upgrading.

The total costs or contributions to the project (as of March 2011) were:

- US AID: US\$ 13,6 million.
- The 3 target utilities: US\$ 31,1 million
- Government of India: US\$ 3,0 million.

Giving an overall total of approximately US\$ 50 million (ZAR 320 million)

The financial model is one of substantial aid money to effectively seed the project, the national

Government coming to the table with a small portion and the electricity utilities picking up the bulk, approximately 2/3rds in the case of the DRUM project.

The target undertakings each secured loans from Power Finance Corporation (PFC) of the Ministry of Power at 11,5% interest and added their own funds. USAID provided their grant component through the PFC. In the case of the Maharashtra State Electricity Distribution Company Ltd (MSEDCL) the Government of India also provided directly a small grant.

The DRUM project also addressed as sub-objectives various financial/funding processes and structures such as:

- the development of alternative financing mechanisms for distribution undertakings that include concepts such as long-term debt, partial equity, grants and credit guarantees.
- alternative lending schemes for distribution undertakings, e.g. public investment agencies such as the Rural Electrification Agency (REC) of India, based on commercial principles rather than third-party government guarantees
- engagement of Indian private credit rating agencies in credit worthiness assessments
- development of term lending structures that include covenants (such as benchmark performance standards), pricing and duration periods that match the (long) life of distribution assets.

However the major impediment to establishing effective funding mechanisms remains the continuing negative financial situation of India's electric undertakings largely as a result on the institutionalised system of subsidised electric power, epitomised by the provision of electricity free of charge to the agricultural sector. There has nor been a significant change in the financial viability of the electric power sector over the period that the DRUM project has been in place. The profit and loss data indicates that even with Government of India subsidies all major electric utilities in India have a negative cash flow and a continued financial loss for their operations. Most individual electric undertakings would be considered bankrupt by U.S. financial standards.

To extend the DRUM pilot projects to the entire distribution industry in India would involve huge sums of money. The scaleable and reproducible principles<sup>15</sup>. The Aurangabad Urban Division is just one of 178 distribution divisions within the Maharashtra State Electricity Distribution Company Ltd (MSEDCL). Assuming that 2/3 of the total DRUM budget of US\$ 50 million went to the 3 pilot projects. To replicate this for all the distribution divisions of MSADCL would amount to US\$ 2,5 billion (ZAR 15 billion say). Then, if of all the states of India, say 15 are comparable in terms of distribution undertakings or divisions, the total cost to replicate DRUM throughout India would be US\$ 30 billion say (ZAR 200 billion)

The sum of money debated in South Africa as necessary to refurbish and upgrade our distribution system varies from ZAR 30 billion to 65 billion.

Clearly in South Africa's case consideration will have to be given to the funding models to meet such a bill. Aid money/grants could be an option but it would depend on the willingness and ability of the funding /lending agencies to come to the South African party as USAID have done so for DRUM in India. None of them are under any obligation to us.

Aid money may also not sit comfortably with municipalities in SA. Normal practice is for any beneficiaries procurement policies and practices to be subjugated to that of the lending entity. Thereby compromising any procurement preference policies and financial management regulations in place to meet the specific local social and political objectives.

The Public Private Partnership approach or similar model for financing of the much needed upgrading and refurbishment may therefore be the best model to apply in South Africa. A model that seems to have been successful in the case of the North Delhi Power Ltd (NDPL) undertaking. Implementation of a Public Private Partnership or similar model would need to be attractive to private investment which would need proper independent feasibility studies to be done in order to go to the market.

## 8. Drum Project Outcomes

Overall the results of the DRUM project have been judged to be mixed. There were notable successes in all three focus areas, but the fundamental stated objectives that the projects would be replicated have not been achieved.

The objectives were to

- establish the framework, institutional capacity, and project development functions at the central and state levels, and
- enable implementation of several full-scale, commercially replicable distribution initiatives in key reform states in India

There has been no replication of the DRUM reform initiatives to date. This failure may be a result of a flaw in the initial design and strategy of the DRUM programme, specifically the lack of a coherent replication strategy. The replication could still happen, especially as the final results of DRUM become better known and more efficient dissemination of the information arrive at diverse utilities throughout India.

One of the key reasons for reforming the electricity distribution system in India is not only to improve the quality and reliability of electricity in India, but also to make the sector more attractive to private investment. There has however, little evidence of an increase in private sector participation at the pilot sites as a result of DRUM.

The functional training programme has been considered a success, a measure of which is that it will continue even after the DRUM project comes to an end in 2012. To this extent they are fully sustainable. There is concern though that the training was overly focused on outputs (number of people trained) and not enough focused on outcomes (what did the people learn and how). It is also recognised that training itself cannot achieve the kind of reform or transformation that is needed.

On the hard performance issues DRUM did result in significant improvements within the pilot sites. For the Aurangabad Urban Divisions of the Maharashtra State Electricity Distribution Company Ltd (MSEDCL) where Mott MacDonald was part of the professional team the improvements over the period October 2005 to June 2010 were:

- Power interruption events per month: Down from 74 per customer to 7.
- Power interruption duration per month: Down from 29 hours to less than 4 hours.
- Transformer failures. Decreased from 13% to 1,5%
- Proportion of customers satisfied that meters read correctly: Up from 25% to nearly 100%.

For the 3 DRUM pilot sites as a whole the proportion of energy supplied but not-paid-for dropped from 53% to 15%.

One weakness that was identified in the DRUM programme was the absence of systematic maintenance plans for the technological upgrades which with time could detract from the benefits of the upgrades. An objective has thus been set to help the pilot sites develop systematic maintenance plans before the DRUM project officially ends.

## 9. Conclusions

We have been on track in the choice of India as a reference country in terms of the starting objective of this paper. India proving to be a country where conditions in which distribution undertakings operate being not too dissimilar to, indeed probably more extreme, than South Africa.

One characteristic where India however differs from South Africa is the staffing levels, with Indian undertakings being grossly overstaffed, at least on the evidence of the data from the one DRUM pilot project report. In contrast the South African undertakings are understaffed in many instances.

A corollary conclusion from this latter characteristic is that to be sustainable it is important that the staff

have the adequate levels of skill, experience and competence. Numbers alone are not enough.

The DRUM project has however demonstrated that appropriate functional training is a key component to successful reform. It is also an aspect where South Africa could commence immediately, irrespective of the timing as to when reform and restructuring will commence again in earnest, as it inevitably must, and whatever the final structure of the industry will be.

Throughout the paper a number of “sign posts” or pointers for us in South Africa are identified. In essence these are conclusions, albeit of a more specific nature, even though we have not repeated them in this Conclusion section.

Unfortunately there were no indicators of reform and restructuring being a quick fix process in environments and conditions that prevail in India (and South Africa) Although the DRUM project has led to achievements and positive outcomes, it never the less ran a course of 8 years. Not a significantly lesser period than the South Africa REDs Blueprint and EDI Holdings endeavour which ran a course of 10 years, although after this period it finally foundered and came to an end.

Public Private Partnerships or similar models for financing of the much needed upgrading and refurbishment coupled with focused Functional Training of utility staff would seem to be the best options for South Africa arising from the DRUM experience in India.

Outside project management and expert technical support to the Utility management were critical to the success of the DRUM pilot projects. Similar such programmes are considered to be unlikely to succeed, let alone commence, without such support as management time is invariably taken up with the day-to-day running of the existing operational business.

The overarching conclusion, which is almost stating the obvious, is that unless distribution undertakings are fundamentally financially viable and the undertaking income is capable of supporting

- a) both the purchase and sale of electricity and the delivery thereof, with an acceptable level of losses, technical or otherwise (“shrinkage”) and
- b) funding of the expansion of the system, its maintenance and upgrading

we will not have an electrical supply industry that can sustain delivery of an adequate and reliable supply to customers into the future.

To sum up the conclusions in a single sentence. For reform and upgrading to succeed the electrical distribution industry requires:

- Sound financial business structures and
- Quality, not quantity of people.

## **10. References & Acknowledgements**

The documents that have been the primary source of information and reference for this paper are listed in Appendix 2. In having drawn extensively from these documents we specifically acknowledge the organisations who have produced and authored them, namely:

- United States Agency for International Development (USAID)
- CORE International Inc
- PA Consulting Group /Tetra Tech
- KPMG and
- Premier Mott MacDonald

Other documentary references which we have used are as noted in the footnotes.

As the Principal Authors we specially acknowledge the direction and reference document sources we received from our co-authors in India, Sadiq Shafiq and Veena Gupta. In particular, their identifying the DRUM project as an undertaking that met our starting objective for the paper and making the point that a strategy of DRUM, which is not acknowledged in the documents at our disposal, was to deliver a solution that was focused on the Indian industry situation rather than trying to apply established European or US practices.

We also specifically acknowledge the input and ad hoc comments we received from

- Vinod Shrivastava from CORE International in Washington, who furnished also us with two of our primary source documents, and
- Dr Prem Mahi, our Mott MacDonald Power Unit International Business Development Director based in Brighton, UK who has extensive knowledge on India and its power industry.

India is the original home country of both Vinod Shrivastava and Dr Prem Mahi.

We acknowledge those in South Africa who assisted us with comparative South African statistics in order to put India into a South African context, in particular Peter Fowles and Dr Willie de Beer.

Finally we also acknowledge the input we received from our colleague in the Project Finance division of our Mott MacDonald South Africa office, Jim Grundy, for his input and guidance on the Financial aspects of this paper and the best practice procedures for establishing Public Private Partnerships.

R A J Frantz  
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Johannesburg and Kenton-on Sea  
2011-09-11

## APPENDIX 1

Papers presented at AMEU Conventions and Technical Meetings relating to Distribution Industry Distribution and Associated Management Practices.

10 Year Period : 2000 to 2010

Year	Title, Author And Organisation
2000	- Restructuring of the EDI – Howard Whitehead.
2001	- Building successful electricity distribution utilities in South Africa – F Cranmer (Anderson). - The Impact of Restructuring on the stability, revenue performance and price of the Overall South African Metering System – Wouter Brand (Eiportne Systems Engineering). - Skills Retention and Performance Management – International Trends – Maureen Hovy.
2002	- Preparing for RED's Ahead – Clr. TG Lobe (Mangaung). - Ringfencing and Asset Valuation Strategy – Ron Millard (PB Power).
2003	- The RED's: making it work – Dr. Shaheen Ahmed, PB Power SA and Ralph Parmella, PB Power UK. - Financial implications of RED's – Chris Gadsten (National Treasury). - International trends: Regulating the electricity distribution industries in the worlds – R Fairbairn (IPS Energy Consulting, Edinburgh, UK). - An overview of the Norwegian regulation and tariff system – Lisbeth Vingas (NVE, Norway).
2004	- Benchmarking in the assessment of distribution businesses – David Bailey, Floren Castro and Cliff Jones (Sinclair Knight Merz). - The odyssey towards corporatisation – a roadmap for RED's ahead – At van der Merwe (EDI Holdings).
2005	- EDI restructuring – Phindile Nzimande (CEO of EDI Holdings). - Restructuring: where to we start? – A Viljoen (Rustenburg Local Municipality). - Benchmarking and regulation – advantages and conflicts – Ron Millard (PB Power SA) and Anthony Seipolt (PB Associates Australia). - Electricity restructuring: impact on the "remaining" municipality - Ryno Matthee (Accenture Resources Operating Group).

2006	<ul style="list-style-type: none"> <li>- EDI restructuring process update and the way forward – Dr. W de Beer on behalf of P Nzimande (EDI Holdings).</li> <li>- Transformation, mergers and acquisitions – a management perspective – Dr. W de Beer (EDI Holdings).</li> <li>- Six issues affecting restructuring of electricity distribution – Prof. T Gaunt (University of Cape Town).</li> </ul>
2007	<ul style="list-style-type: none"> <li>- Progress towards sustainable RED's – Dr. W J de Beer (EDI Holdings).</li> <li>- Building capacity for the unfolding RED's in EDI – Naudé van Rensburg (Eskom).</li> </ul>
2009	<ul style="list-style-type: none"> <li>- Practical perspective of the RED business model – Dr. Willie de Beer (EDI Holdings).</li> </ul>
2010	<ul style="list-style-type: none"> <li>- International practices and trends for managing municipal and utility infrastructure – Mark Damm (Fuseforward International)</li> </ul>

## Appendix 2

### Main Reference Documents

1. Evaluation of DRUM and WENEXA. United States Agency for International Development. April 2011.
2. DRUM – Training: Design and Approach. CORE International Inc.
3. DRUM Project. Detailed Project Report. Maharashtra State Electricity Distribution Company Ltd. Prepared by PA Consulting Group, KPMG and Premier Mott MacDonald for United States Agency for International Development January 2006.

## Appendix 3

### Detailed definition of DRUM Training target groups.

- Utility Senior Management  
Members, Directors, Chief Engineers, General Managers, Superintending Engineers.
- Utility Middle Management  
Superintending Engineers, Executive Engineers, Assistant Executive Engineers, Managers.
- Utility Junior Management  
Assistant Engineers, Junior Engineers, Feeder Managers.
- Utility Technicians  
Linesmen, Foremen, Meter Readers, Electricians, Technicians, Bill Collectors.
- Other Stakeholders  
Regulatory Staff, Policy Makers, NGOs, Customer Organisations, Equipment Suppliers, Vendors.

## Appendix 4

### DRUM PROJECTS

#### Maharashtra State Electricity Distribution Company Ltd (MSEDCL)

(Break trough projects indicated in bold)

#### ASSET MANAGEMENT

1. **System Mapping and Planning**
2. Refurbishment of Substations
3. Repairs and Upgrade of Networks and DTRs

#### SYSTEM OPERATIONS AND DISPATCH

4. **Automatic Remote Monitoring of SAIDI, SAIFI, CAIDI, and Voltage**
5. **Control Centre**
6. Automatic Meter Reading on DT Meters

#### FIELD OPERATIONS

7. Safety Equipment and Upgrades
8. Maintenance
9. Outage Management
- 10. Construction Works Management**
- 11. Metering Test Equipment**
- 12. Meter Management**

#### **CUSTOMER PROCESSES**

13. New Connection Management
14. Tracking of Pilferage Cases
15. Prepaid Metering

#### **CORPORATE PROCESSES**

16. Best Practices
17. KPIs
- 18. Training Trips**
- 19. Storage: Handling and Facilities**
20. Energy Audit & Accounting
21. Finance and Accounting
- 22. Projects Management**
23. Asset Management
24. IT Infrastructure (A Fast Track Project)
- 25. IT Disaster recovery**
- 26. IT Configuration / Release / Change Management**
- 27. IT Asset Tracking**
- 28. IT Help Desk**

<sup>1</sup> International practices and trends for managing municipal and utility infrastructure – Mark Damm(Fuseforward International)

<sup>2</sup> Ministerial Summits on National Electricity Distribution Maintenance. Papers presented by RAJ Frantz: 2003: Engineering Experience Considerations for the Control and Operation of Electricity Distribution Businesses 2008: Time, Leaders, Danger and Discipline, Managing for the Future. A personal view from the 2003 National Electricity Distribution Maintenance Summit

<sup>3</sup> Reference: CIA World Fact Book

<sup>4</sup> Reference: CIA World Fact Book

<sup>5</sup> Reference, Free Market Foundation Conference “Unlocking the electricity transmission grid - An independent system and market operator for South Africa” Sandton, 9 June 2011: Presentation by Barun Mitra, Liberty Institute, New Delhi: “Indian Electricity Scenario: A few salient points”.

<sup>6</sup> SALGA National Conference 31 August 2011 – Paper titled ‘Accelerating the Pace of Ensuring Access to Sustainable Municipal Services for All’

<sup>7</sup> Varies with source of information..

<sup>8</sup> Acknowledgement: “DRUM - Training: Design and Approach. US Aid, Indian Ministry of Power and CORE International, Inc Washington DC and New Delhi.

<sup>9</sup> DRUM Project – Detailed Project Report - Maharashtra State Electricity Distribution Company Ltd: Section 2.5.3 Training (Page 63)

<sup>10</sup> Refer reference document 1 (Appendix 2) “DRUM Training and Private Sector Success: A positive return on investment.” (Page 15)

<sup>11</sup> The conurbation of Mumbai is located in the state of Maharashtra

<sup>12</sup> Acknowledgement: “ Evaluation of DRUM and Wenexa. United States Agency for International Development. April 2011”.

<sup>13</sup> “Model Distribution Company and Best Practices” Inderjit Anand and Jim Hogan, Published by PA.

<sup>14</sup> “Model Distribution Company Framework, MSADCL Aurangabad”29 August 2005, Published by PA.

<sup>15</sup> Scalability and Reproducible principles. The ability to maintain performance, usefulness, or usability regardless of expansion from concentration in a local area to a greater distributed pattern. Recognised as a key characteristic of successful large multinational businesses. A concept that is also well known in large computer systems. There are many examples in nature, e.g. leaves and trees. The concept has its origins in the mathematics of complexity or chaos.