ASSET VALUATION – A PRACTICAL APPROACH TO VALUING MUNICIPAL POWER SYSTEM ASSETS

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Abstract. This paper describes a practical and cost-effective approach to valuing municipal power infrastructure assets. It discusses issues relevant to the data capture and valuation process, and offers a pragmatic solution for municipalities, allowing them to quickly create an asset register with a high level of confidence. Furthermore a sustainable process can be implemented to maintain and enhance the asset data, providing ongoing business benefits to other operational units in the municipality.

1 Introduction

Assets, for the purpose of this paper, are defined as any item of economic value owned by a corporation, especially items that could be converted to cash [1].

1.1 *Drivers for Asset Valuation*

The current restructuring of the Electricity Distribution Industry (EDI) in South Africa has necessitated that Municipalities compile an up-to-date valuation of their electricity assets in preparation for the establishment of the Regional Electricity Distributors (REDs).

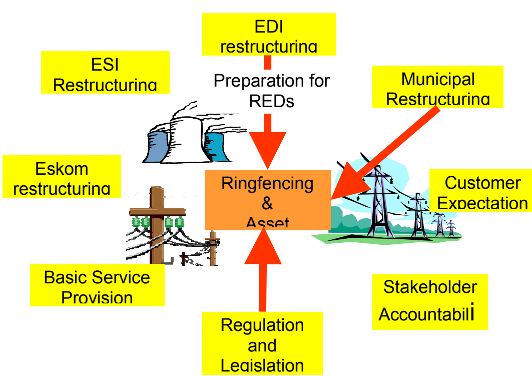

Figure 1: Key forces impacting on local electricity industry.

However, notwithstanding the need to prepare for the EDI restructuring, there are a number of other good reasons for maintaining an equipment asset register of high quality, as noted in section1.4.

1.2 *Objectives of Asset Valuation*

The main objective of the asset valuation process is to have a complete and independent assessment, in terms of value and general condition of the municipality's electricity assets[1], according to acceptable industry norms, ensuring that the efforts are in line with the requirements from EDI Holdings to be "Ready for the REDs". A secondary objective is to ensure that the exercise is done cost-effectively and that the asset data is maintained and enhanced over time.

Typically, we are aiming at the:

- Creation of a comprehensive asset register
  - robust data model
  - standard asset categories
- Determination of the age of equipment
  - expected useful life
- Evaluation of equipment condition
  - refurbishment requirements
- Valuation of assets
  - Depreciated Replacement Cost method

1.3 *Financial considerations*

Some important financial considerations need to be taken into account when establishing an asset register. Municipality's generally have some form of an asset register in existence. However this is usually out-of-date, and does not meet current legislative requirements for municipal financial systems.

In terms of the new Municipal Finance Management Act (MFMA), the municipality's asset register needs to comply with Generally Accepted Municipal Accounting Practice (GAMAP) requirements.

It is not intended for this paper to elaborate on detailed financial requirements, but it is noted that GAMAP 113 describes how Property, Plant and Equipment should be handled, including the definition of the categories and lifespan for electricity infrastructure assets (amongst others). This section provides the minimum requirement for a Financial Asset Register. This is inadequate for the broader management of electricity infrastructure assets in a utility.

From a financial viewpoint, the asset valuation is important for the following reasons:

- Sale of Business Agreement
  - Opening Balance Sheet
  - Depreciated Asset Values
- Financial Model / Financial Statements
  - Opening Balance Sheet
  - Annual depreciation charges
- Determine shareholding in the future RED
- Cost Reflective Tariff Structure
  - Cost of Supply Model

1.4 Other benefits

Regardless of the status of EDI restructuring, or the timing of an individual municipality being incorporated into a RED, it is generally good business practice to have a thorough understanding of your assets in some detail.

If planned correctly from the start, the data can be captured, stored and presented in such a way that it will provide significant additional benefits for other departments in these areas:

- Managing power system resources better
  - Operations (network model and analysis, switching operations)
  - Trouble call response time
  - Maintenance planning & execution
  - Refurbishment planning
- Manage financial aspects
  - Maintainable Asset Register
  - Annual depreciation calculations
  - Refurbishment requirements (CAPEX)
  - Operational (OPEX) budgeting and forecasting
- Ensuring ongoing future data capturing, maintenance and quality improvement
  - Data sets useable by existing and future information systems.
  - Value of data insulated from changes in technology and vendor products.

2 Approach

The assets of a municipal electricity department usually fall into one of the following asset categories:

- Power System Resources
- Property
- Vehicles
- Information Systems
- Stock
- Machinery & Equipment
- Miscellaneous

Typically, power system infrastructure, together with land & buildings, constitutes the majority of asset value for Transmission and Distribution utilities.

- Power System Resource (PSR) assets: 90% to 95% of all asset value
- Land & Buildings assets: 3% to 5% of all asset value
- Together, totalling between 96% and 99% of all asset value

It is therefore prudent to focus the majority of effort on these high value asset types in order to ensure accuracy and a high level of confidence when establishing an asset register. It is not cost-effective to get bogged down unnecessarily in details that do not add any measurable value.

2.1 Asset Attributes

As a minimum, attributes contained in the Asset Register should allow the following questions to be answered [1]:

- Where is the asset located?
- What is the asset type/category?
- What quantity of this asset type is present?
- What is the age of the asset?
- What is the perceived condition?
- What is the expected useful life?
- What is the replacement cost?
- What is the depreciated replacement cost?

2.2 *Power System Resources (PSR)*

PSR assets are filtered into a number of categories and sub-categories to form a hierarchy as indicated below.

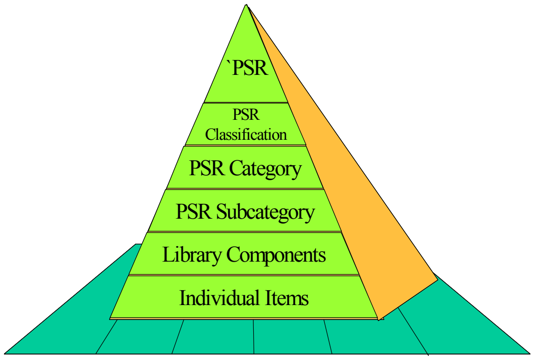

Figure 2: PSR asset hierarchy

The general PSR classifications are:

- Generation
- Transmission and Subtransmission (can be treated separately)
- Distribution
- Network Management Systems

The PSR categories and sub-categories are defined logically according to items of similar type and expected useful life.

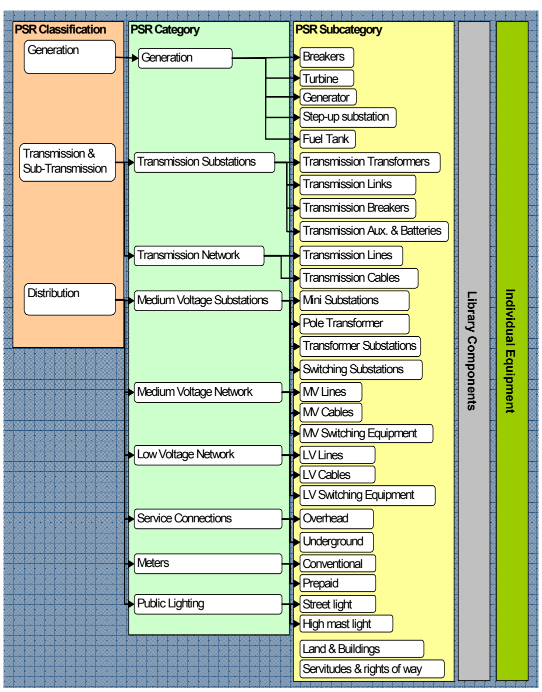

Figure 3: PSR categories and sub-categories

The main PSR categories and sub-categories under these respective classifications are:

- Substations
- Networks
- Meters
- Service connections
- Public lighting (where applicable)

Network asset data is typically not in a complete state. One of two methods can be employed to get it to an acceptable level of quality, in terms of accuracy and completeness. Firstly, an extensive field data capture project can be specified. Depending of the extent of the municipality, this can be an expensive exercise. Alternatively, engineering techniques can be used to compute representative estimated values, i.e. a proxy method can be used.

In the event that a proxy methodology is used, the following points are relevant:

- this methodology requires a framework for data management
- this is best done with the use of GIS technology
- proxied data must be clearly flagged in the equipment database / asset register
- future data capturing should replace proxied data with actual plant data

A methodology has been developed by NETGroup for utilities to quickly get a view on asset value with a high level of confidence. This has been tested and streamlined over a number of asset valuations in recent years.

3 Valuation Methodology

An asset valuation for electricity infrastructure can be done in a number of ways, with the main methods being:

- Depreciated Replacement Cost (DRC)
- Discounted Cash Flow (DCF)

The assessment criteria against which the potential approaches should be evaluated include:

- Cost effectiveness
- Practicality, mainly data availability
- Regulatory constraints

For example, the DCF model requires specific financial inputs that are often not readily and accurately available, which makes this method difficult to execute in practice.

An alternative method is to establish original cost (purchase price), add escalation, and apply a straight-line depreciation. This can only be applied consistently if the local accounting practice allows it.

The Depreciated Replacement Cost (DRC) method of valuing network assets is the most practical. This is generally accepted as the preferred method, and it is in line with EDI Holdings requirements.

3.1 Depreciated Replacement Cost (DRC)

As mentioned, the DRC is determined on the basis of the Replacement Cost (RC) for Modern Equivalent Assets (MEA). The replacement cost is depreciated according to the age of the asset and the expected useful life (UL) for the asset type. The diagram below illustrates this concept.

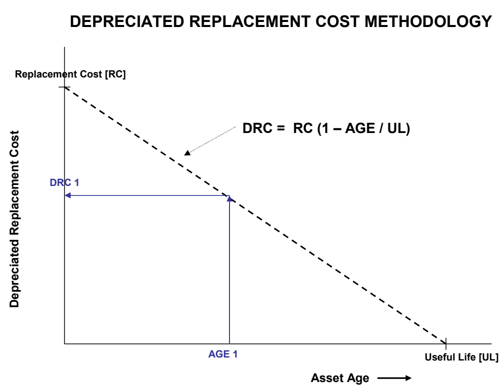

Figure 4: DRC methodology

The perceived condition of the plant is used to adjust the age of the plant, and influence the current DRC.

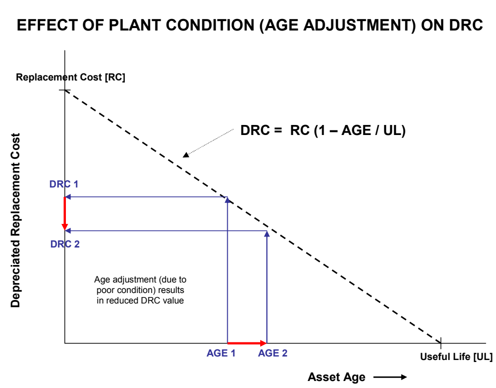

Figure 5: DRC method taking plant condition into account.

The effect on the DRC calculation is indicated in the diagram above. This adjustment factor can have either a positive or negative impact depending on the condition of the asset relative to its current age and expected useful life.

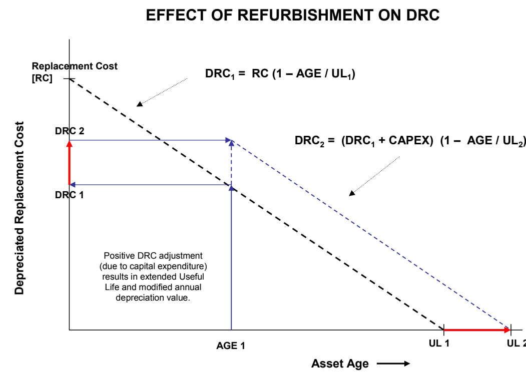

Figure 6: DRC method taking refurbishment into account.

Refurbishment expenditure is a further factor that should be covered in the overall valuation of assets. The diagram above illustrates how refurbishment not only increases the current asset value, but it also extends the remaining useful life of the plant, requiring the annual depreciation calculation to be adjusted.

4 Power System Resources Data

4.1 Existing Data

In order to minimise expenditure on data capture, existing data sources should always be used to their full extent as a first option.

Typically, data and information can be captured, and translated into an appropriate format, from a number of existing sources, including the following:

- GIS datasets
- CAD drawings
- Paper-based drawings
- Single-line network diagrams
- Existing asset lists
- Records of field audits and inspections
- Discussions with municipality personnel

Most municipalities in South Africa do not have any generation assets, and many do not have significant quantities of transmission or sub-transmission assets. These asset categories can be accounted for quite easily, or alternatively it is usually cost effective to go out and capture the equipment details in the field.

Generally as illustrated on the map below, some, if not most, MV distribution network data will be inaccurate, incomplete or non-existent. Almost certainly, the data for the LV distribution networks will be incomplete and inaccurate.

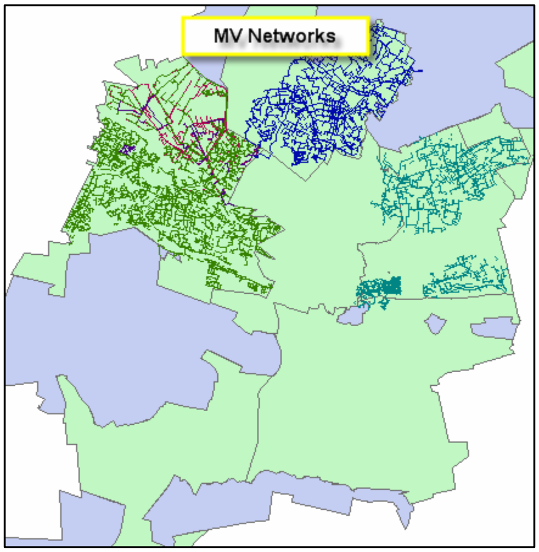

Figure 7: Map indicating partial availability of MV asset data

Depending on the extent of the missing or incomplete data, and the costs involved, a decision will have to be made whether to send field crew out to physically capture the data, or whether to use an approximation (proxy) method for selected assets types in certain areas.

4.2 Field Data Capture

If a decision is taken to capture raw data in the field, this exercise should be carefully planned and managed. The use of appropriate field-to-office (FTO) technologies, like GPS receivers and data loggers, will ensure maximum efficiency and allow a number of other functions to benefit from the captured asset data.

Typically, the field exercise can be used to capture asset data and perform other network related activities at the same time. This could include the following:

- GPS coordinates for specified equipment
- GIS asset database for network equipment
- Electronic database attributes as specified
- Digital photo for all specified equipment
- Plant age / condition assessment
- Verification of existing plant data
- Pole numbering / labelling
- Transformer numbering
- Wooden pole inspection

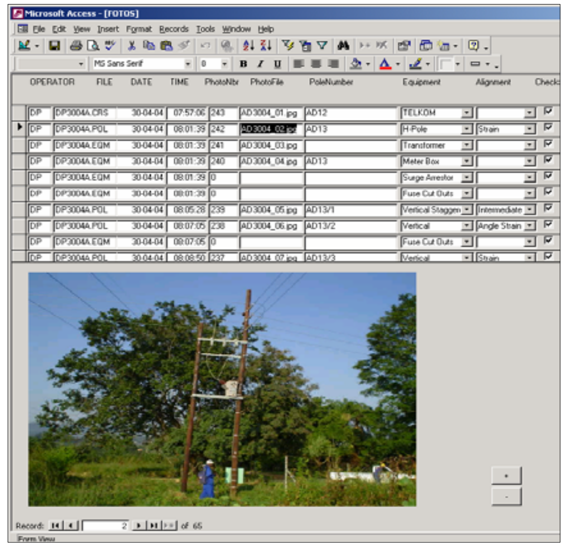

Figure 8: Example of database populated with field captured asset data, including an associated photograph.

4.3 Proxy methodology

In the event that it is considered too expensive to undertake a field data capture exercise, the 'proxy' (estimation) approach can be used to obtain a reasonable estimation of the quantities of MV/LV distribution equipment, and their values, in a short space of time. If computed using sound methods, the proxy approach can yield results with a high level of confidence.

The following points motivate the use of the proxy methodology:

- Distribution, especially the LV reticulation level, contains a huge volume of equipment making physical inspections impractical
- Will be a massive cost and time implication to physically capture this information
- It is usually only necessary to proxy values for areas where infrastructure data for certain asset types is not available
- Special equipment is required to trace cable networks
- Proxy methodology provides an acceptable estimate of actual equipment
- Proxy is a starting point. As information becomes available, the proxy figures are replaced with actual asset data.

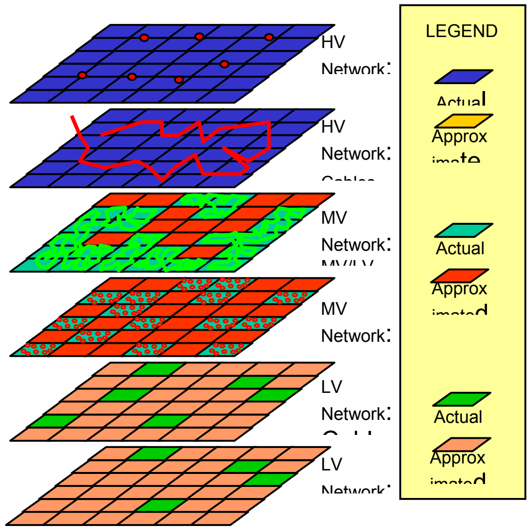

Figure 9: Conceptual diagram illustrating the degree of proxing necessary for the different levels of network data

NETGroups proxing methodology is based on land use classifications for different customer types. Typical equipment types and volumes are associated with these land use areas to derive an expected quantity / value of electrical infrastructure in that area.

GIS tools, and aerial photographs, are especially useful to aid the data capturing process, as well as compute the proxied results.

Field verification of land use type, plant existence and a general quality assessment of the asset data should always be undertaken, especially in the proxied areas.

Figure 10: Aerial photograph verifying discrete land use types captured into a GIS

Figure 11: Aerial photograph indicating location of MV assets, used to determine proxied values.

The aerial photograph above illustrates how existing assets are used to estimate quantities of similar asset types in areas of similar land use. This is done with the aid of database software designed to compute proxied values per asset zone (defined in the GIS), and asset type, as indicated in the diagram below.

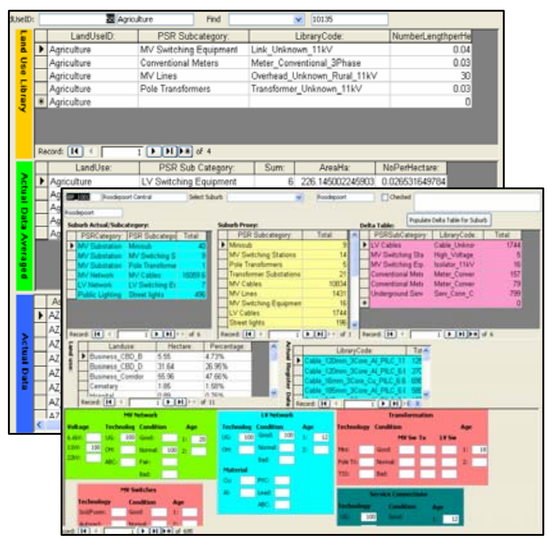

Figure 12: Database application designed to compute proxied asset quantities per asset zone.

5 Asset Register

5.1 Data Attributes

Assets should be clearly and uniquely identifiable in the asset register as far as possible. As many relevant technical and financial attributes should be attached.

The following are indicative of the attributes required to ensure GAMAP compliance:

- Asset Description
- Asset Location
- Asset Category
- Substation Name
- Functional Location Code
- Asset Quantity
- Year Commissioned (if available)
- Year Refurbished (if available)
- Year Manufactured (where available)
- Serial/Registration Number (if available)
- Condition Grading

5.2 Data Model

Most electricity utilities have huge amounts of data to capture and maintain in order to manage their assets better and ultimately improve service delivery to their customers.

It is important to design an appropriate data model and database schema that will provide the framework for the Asset Register.

A logical and robust data model, based on the IEC Common Information Model (CIM), is available to support the business strategies and processes of any electricity utility. The CIM is an international Industry Standard that can be utilised as the basis for the design of the asset database in the GIS, and expanded along the CIM model lines as and when appropriate.

It will also assist in the maintenance of data in the future.

The diagram below illustrates the concept of a simple data model.

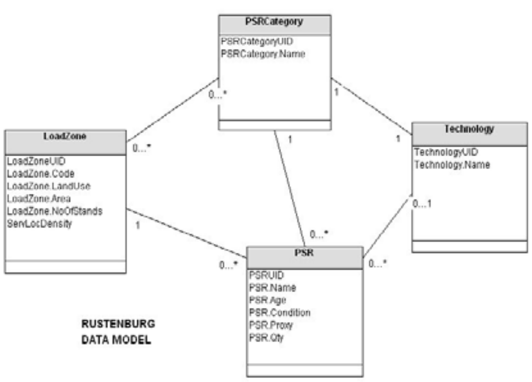

Figure 13: Conceptual diagram of a simple data model

5.3 Reporting

The asset database should ideally be a common multi-purpose database, serving a number of operational units in the business. The generation of a Financial Asset Register will be only one of the views of the PSR data contained in the asset database.

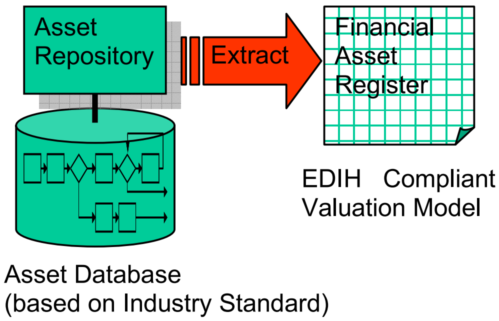

Figure 14:Typical asset database application designed to extract relevant asset data for valuation purposes

6 Asset Valuation

6.1 Equipment Library

The asset library contains the latest equipment replacement costs (RC) on the basis of the replacement costs for Modern Equivalent Assets (MEA). The replacement costs cover all cost components required to bring the asset into service, including material, labour, transport, professional engineering services and Interest During Construction (IDC).

International best practice should be applied in defining the expected useful life for equipment categories. This must be adjusted, where necessary, for specific local conditions.

6.2 Age and Condition of Equipment

After the asset quantities have been determined through one of the above methodologies, the following attributes are required to calculate the Replacement Cost and Depreciated Replacement Cost of the PSR assets:

- The age of network components
- The perceived condition of the equipment relative to its expected useful life

Sample audits at a number of selected sites will provide adequate verification of data quality.

Work-under-construction (WUC) should be quantified and capitalised.

6.3 Valuation

The asset valuation will be computed for a specified Valuation Date, usually the financial year-end date.

It is important that an audit trail be left with regards to details of methods used, data sources, references and assumptions that were used to evaluate equipment.

6.4 Validation of Results

The overall approach described has been used on other similar Asset Register and Asset Valuation projects undertaken for municipalities like Johannesburg (City Power), Manguang, and Cape Town. In the case of the Johannesburg (Metelec) asset valuation, the exercise was subjected to a Due Diligence review, and found to be acceptable.

Furthermore some benchmark indicators have been determined from previous projects.

It is however strongly recommended that further field verification and assessment of asset data be undertaken. This will reduce the uncertainty, improve the accuracy of the age/condition data, and firm up the level of confidence in the computed asset values.

Typically the following Confidence Levels can be achieved:

- Generation valuation – 98%
- Transmission valuation – 98%
- *Distribution (MV) valuation - 90%
- *Distribution (LV) valuation - 80%
  - *depending on the availability of quality data.*

7 Asset Management

7.1 Data Maintenance

Many data capture or clean-up projects are once-off exercises, resulting in wasted time and money once the data becomes out of date. Building a culture of data maintenance within the municipality, and defining the responsibilities for data maintenance will ensure asset data of lasting quality. This will avoid the need for rework later, and ensure that a high level of confidence is maintained in the dataset.

Where proxied data has been used, it will be necessary to enhance the Asset Register over time through detailed field data capturing, replacing proxy calculations with actual asset quantities.

Standards for asset data capture and maintenance should be specified, particularly for any new assets added to the system.

7.2 Business Processes

In addition to providing an asset register with associated valuation, it is important to ensure that the related asset management processes are developed into a robust solution to ensure that the assets can be maintained and that duplication of effort in data maintenance is eliminated in the enterprise.

This would require that:

- other systems that are / would be affected by the business processes are identified and that these information exchange events are clearly documented.
- that current Value Chains (business processes) also support the Asset Register function, and that the shortcomings and enhancements of the processes are identified and designed.

Keeping the Asset Register up-to-date is not a complicated process; however it is also not a trivial process. To be effective, it requires the support of top and middle management.

A detailed business process needs to be designed and implemented for the purpose of maintaining asset data, as well as other business data. This process should detail the interfaces between sections and clearly state the accountabilities for the various activities.

8 Asset Valuations completed

In the last 5 years NETGroup has compiled asset registers and computed asset valuations for the following utilities:

- Johannesburg Electricity (Metelec) - 2000
- Lesotho Electricity Corporation(LEC)- 2002
- Cape Town Electricity – 2003
- Mangaung (Centelec) - 2003
- Rustenburg Munic - 2004
- Tzaneen - 2004
- Makhado - 2005
- City Power Johannesburg - 2005

The approach and methodologies described in this paper have been developed and refined through the experience gained in these projects.

In each case different challenges presented themselves, and therefore no single solution can be proposed to address the requirements of every municipal utility in the country. A flexible and innovative approach is required to overcome the issues that arise at each entity.

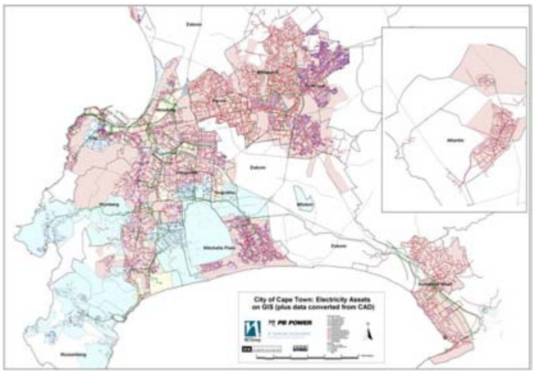

Figure 15: Cape Town Asset Valuation

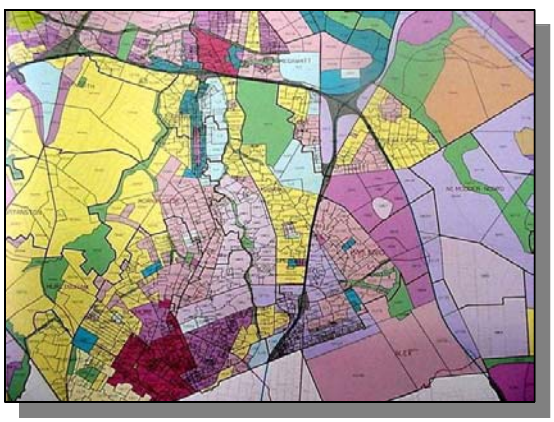

Figure 16: City Power Johannesburg Asset Valuation

9 Conclusion

In conclusion, this paper has shown that through a pragmatic, cost effective approach, it is possible to quickly create an asset register for municipal power system assets and to compute an associated valuation of these assets with a high level of confidence. Furthermore a sustainable process can be implemented to maintain and enhance the asset data, providing ongoing business benefits to other operational units.

10 References

[1] EDI Ringfencing Toolkit Ver1.0 compiled by Accenture for EDI Holdings Co.

[2] DRC Valuation Handbook Rev 1 (2000) compiled by PB_Power for the DME.

[3] Valuation Model (MS_Excel spreadsheet) Ver 1.0 (2000) compiled by PB_Power for the DME.

11 Acknowledgement

The author acknowledges the contributions of his colleagues at NETGroup South Africa to the development and refinement of the approach and methodologies discussed in this paper.

12 Biography

Melville Fish is an electrical engineer with some 20 years practical experience in the utility industry. His experience in utilities varies from generation and transmission, to sub-transmission and distribution.

Melville graduated from the University of Cape Town with Bachelors degree in electrical engineering. He did his practical training with Eskom, obtaining experience mainly at Koeberg Nuclear Power Station, and in various departments throughout Eskom's Western and Eastern Cape Distribution Regions.

His experience includes: network operations, network development and master planning, project engineering, project management, as well as the user requirements specification of various engineering software tools. Other skills include utility data management, information systems, financial modelling and power system analysis. More recently Melville has focussed on Municipal restructuring and asset valuation to support the EDI process in South Africa.

Melville is currently a principle engineering consultant in NETGroup's Utility System Consultancy division.