# CHAPTER 6 CONCLUSION AND EVALUATION

## 6.1 INTRODUCTION

South Africa is five times the size of Great Britain, with an area of 1 219 912 square kilometres. The total length of overhead lines is more than twenty-three thousand kilometres. According to the transmission electrical network layout (topology), South Africa has been divided into twenty-seven different geographical areas. Each area has its own unique load profile. The weather (short term) and climate (long term) have a significant impact on the maximum transmission system load, and also in certain areas. Also, sector loads (such as the platinum mining) are more dominant in certain areas than in other areas. International and national trends, especially economic cycles, have a significant impact on the transmission loads.

As mentioned in the previous chapters, the transmission load forecast is complex and the importance for providing forecasting results that are more informative is increasing. There is, therefore, a need to develop a number of load forecasts and an algorithm to reconcile the forecasts.



## 6.2 FIELDS COVERED AND RESULTS OBTAINED

The study starts in Chapter 1 with a discussion on the transmission network and the power flow load requirements. The electrical load model described in Chapter 1 includes all forecasts. However, the area per sector and sector load forecasts are not included in the balancing algorithm.

The important factors that have a significant impact on the transmission loads are discussed in Chapter 2. Different load forecasts and the forecasts used as inputs for the balancing algorithm are discussed in Chapter 3. In Chapter 4 the balancing algorithm and its mathematical relationships are defined. The developments in the field of Operations Research and its application to develop the heuristic solutions are also covered in Chapter 4.

In Chapter 5 the results from the balancing algorithm are evaluated. The transmission load forecast methodology is described as a step-by-step approach to produce the loads as required for power flow studies.

## 6.3 EVALUATION

The developing of the balancing algorithm started in 2001 and only after the winter peaks of 2003 has the balancing algorithm been used for the first time to balance the different loads. The checking of the distribution loads against the sector and area per sector loads will start towards the end of 2004. Table 6.3.1 compares the differences between the actual transmission loads and the results from the S-curve.

Table 6.3.1 - Maximum System Loads
(Actual vs S-curve results)

| | ACTUAL | S-CURVE | Difference |
|---|---|---|---|
| 1999 | 27.81 | 29.54 | 1.72 |
| 1999 | 29.19 | 30.49 | 1.30 |
| 2001 | 30.60 | 31.44 | 0.84 |
| 2002 | 31.62 | 32.39 | 0.77 |
| 2003 | 31.92 | 33.34 | 1.42 |

Note: Figures are in GW.



Transmission expansion projects are capital intensive. Risk and uncertainty are always a concern with load forecasts. The electrical load model provides a robust but simple representation of how to structure the electrical loads. The factors can be described as a checklist to ensure that, where possible, all significant impacts on the electrical networks have been evaluated and included. The different forecasts integrate the factors and provide results that can be evaluated. The evaluation is to ensure that the different forecasts' outlooks have interpreted the factors correctly. The balancing algorithm provides an excellent method to ensure that consensus exists between the different forecasts. The results from the S-curve are a smooth line through the actual loads, where the balancing algorithm results fluctuate around the S-curve very similar to the actual loads. . Lastly the reliability of the balancing algorithm results is dependent on the reliability of the different forecasts.

## 6.4 RECOMMENDATIONS

The ranges have to be selected carefully, else the results between years can be unrealistic. It is therefore recommended to develop a number of constraints to overcome the problem. The inclusion of the area per sector and sector loads in the balancing algorithm and the constraints mentioned above will need a (non-) linear software package.

A further development to make the load forecast more informative is a graphical interface system that can display the forecast geographically and with additional information on population, housing, industrial and mining activities, etc.

Lastly, use the line or feeder load profiles (when available) to forecast the transmission substation expected loads.

## 6.5 CONCLUSIONS

In conclusion, the electrical load model provides a robust and an effective structure to evaluate different long-term electrical forecasts. The surveillance on the important factors ensures that the significant impacts (for example international and national trends) on the transmission network are captured. The balancing algorithm makes it possible to ensure consensus exists between the different forecasts, and the balancing process reaches solutions within reasonable time limits. Lastly the developed forecast methodology has improved the transmission load forecasts. The forecasts are more informative and this reduces the elements of uncertainty and risk. Therefore, it can be concluded that the forecast methodology provides a more reliable practical application for transmission network flow studies.