

**THE NEED FOR THE 400KV TRANSMISSION LINES THAT INTEGRATE BRAAMHOEK PUMPED STORAGE SCHEME INTO THE TRANSMISSION GRID**

1 INTRODUCTION

Electricity cannot be stored. It is therefore necessary to generate and deliver power over long distances at the very instant it is needed. In South Africa, thousands of kilometres of high voltage lines transmit power, mainly from the power stations located at the Mpumalanga coal fields to major substations where the voltage is reduced for distribution to industry, businesses, homes and farms all over the country.

According to ISEP (Integrated Strategic Electricity Planning) as done by Resources and Strategy, an additional generation capacity is required by 2012 to support expected loads. Based on all alternatives considered, Braamhoek PSS (Pumped Storage Scheme) is the best option, being the least cost. In order to meet this commissioning date, the design of the scheme must commence in year 2004 and construction must begin in year 2007.

Braamhoek PSS will consist of 4x340MW machines at 0.9 power factor. It is expected that the first unit of the scheme will be commissioned in 2011. The next three units will be commissioned every three months thereafter, with the last unit being commissioned in 2012. Figure 1 shows the location of the scheme relative to the transmission network.

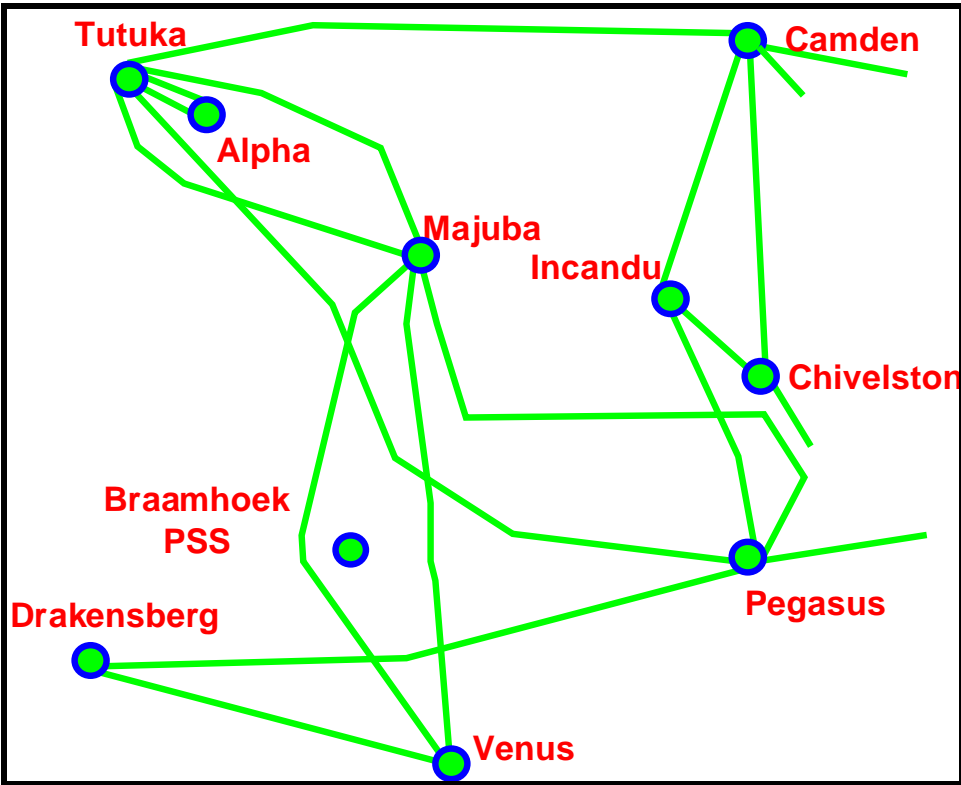


Figure 1 Location of Braamhoek within the transmission grid

At present, Eskom Generation division is authorized by the NER (National Electricity Regulator) to design Braamhoek PSS. The division has no license to build and operate the scheme. The designs that Generation must produce should therefore be generic in nature. Should a different stakeholder (e.g. IPP (Independent Power Producer)) be given the license to build and operate the scheme, the licensee should be able to modify such design to suit the licensee's circumstances. The designs and specifications should therefore be generic in nature.

## 2 *THE NEED FOR TRANSMISSION LINES IN INTEGRATING BRAAMHOEK INTO THE TRANSMISSION GRID*

The integration of a power station into the transmission grid requires that transmission lines connecting the power station to the grid be constructed. This will enable generated power to be moved from power station where it is generated to the grid for transportation to where it is required.

The integration studies to determine required lines are done according to planning criteria for voltage levels and equipment loadings. The studies done are as per Transmission Planning Guide for Integration of Power Stations.

Steady state studies are done to assess capability of integration options to satisfy system healthy and contingency conditions. Dynamic stability studies are also done to analyze dynamic behavior of the system after integration to ensure that fault occurring in the network do not lead to situations of instability.

## 3 *THE NEED TO OPTIMISE THE ELECTRICAL TRANSMISSION SYSTEM IN BRAAMHOEK AREA*

It is clear that new Transmission lines will be needed for integration of Braamhoek Pumped Storage Scheme. The Transmission lines will be brought into operation at the time when the scheme is commissioned. It is however necessary to secure the necessary servitudes timeously, to ensure this will be possible.

Two technically feasible options for integrating Braamhoek Pumped Storage Scheme have been identified. Refer to Figures 2 and 3 below. As in Option 1, Option 2 (Alternative 10) considered looping in the Majuba Venus 2 400kV line into Braamhoek. Instead of building a 400kV line to Venus, here a line from Braamhoek to Pegasus (75km) is considered. Refer to Figure 2.

The Environmental Impact Assessment (EIA) will be done for both options. Results of the EIA will be used to derive line costs. This will be input into making final, optimized decision on which option is preferred. Servitude acquisition will then be made on the basis of that option.

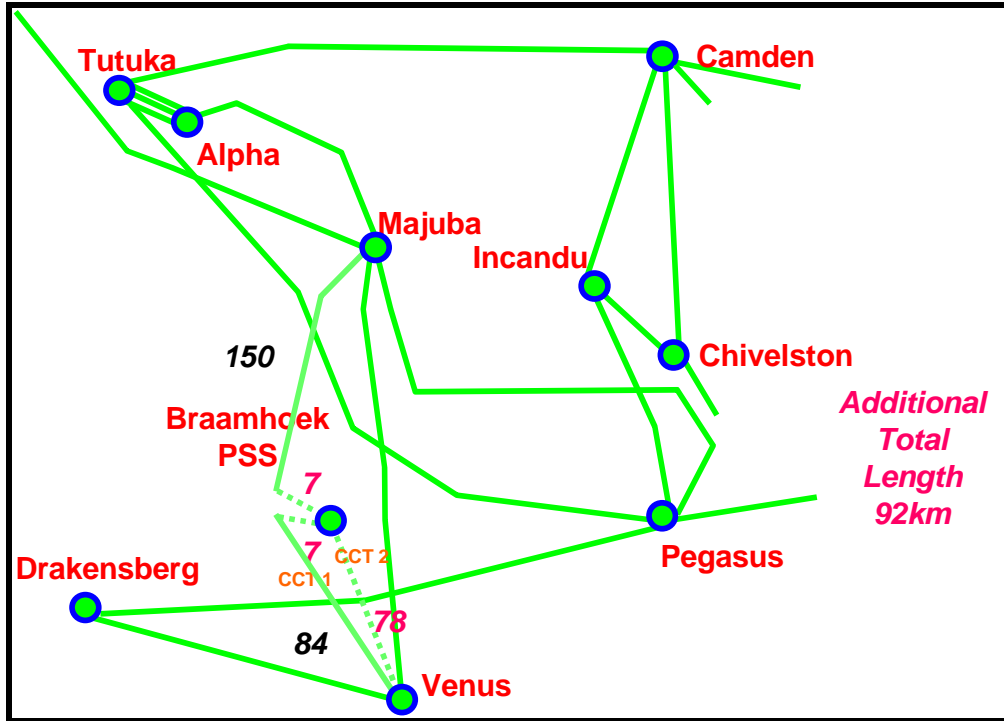


Figure 2 Option 1: Loop Majuba Venus and Build Braamhoek Venus

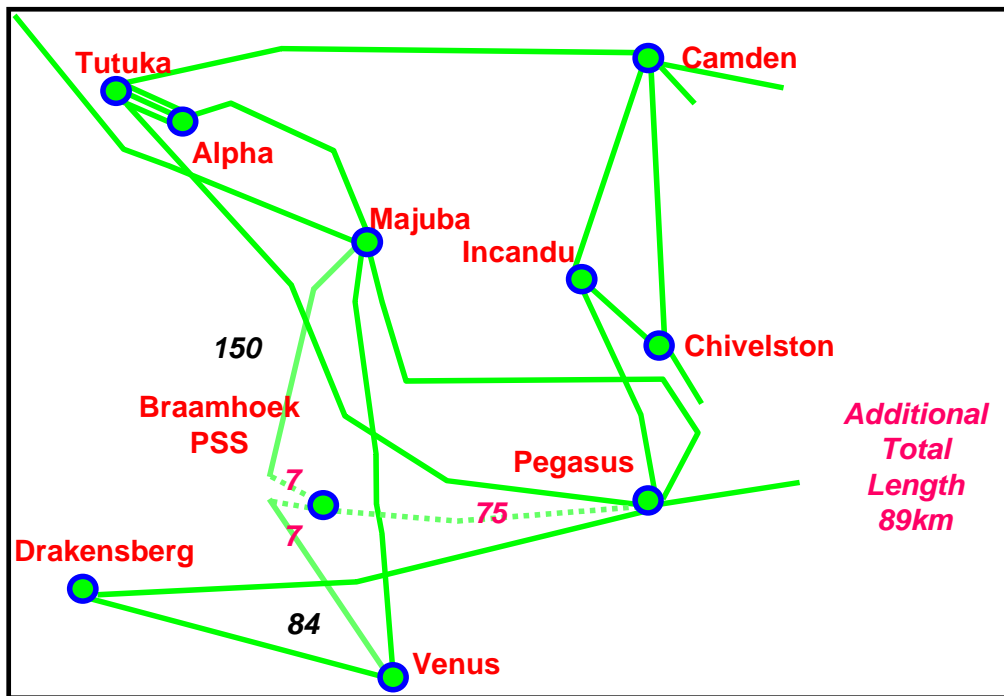


Figure 3 Option 2: Loop Majuba Venus and Build Braamhoek Pegasus

#### 4 *CONCLUSION*

A definite need for Braamhoek Pumped Storage Scheme was identified. In order to integrate this scheme into the transmission grid, new transmission lines will be required and will be commissioned when the scheme comes into operation. It is however necessary to secure the necessary servitudes timeously, to ensure this will be possible.

### 5. **ALTERNATIVES FOR SATISFYING THE NEED**

#### 5.1 *INTRODUCTION*

Electrical supply constitutes a complex system of generation facilities, substations and Transmission lines. The system operates on a demand-supply structure. The power is generated and transmitted at the moment it is needed. Spare generation capacity is currently available in the system supplied by the coal-fired power stations in the Mpumalanga region. It is therefore not necessary to increase generating capacity to cater for the forecast load growth.

According to ISEP (Integrated Strategic Electricity Planning) as done by Resources and Strategy, an additional generation capacity is required by 2012 to support expected loads. Based on all alternatives considered, Braamhoek PSS (Pumped Storage Scheme) is the best option, being the least cost. In order to meet this commissioning date, the design of the scheme must commence in year 2004 and construction must begin in year 2007.

Braamhoek PSS will consist of 4x340MW machines at 0.9 power factor. It is expected that the first unit of the scheme will be commissioned in 2011. The next three units will be commissioned every three months thereafter, with the last unit being commissioned in 2012. Figure 1 shows the location of the scheme relative to the transmission network.

#### 5.2 *ALTERNATIVES FOR SATISFYING THE NEED*

Two alternatives to satisfy the need for additional generation, relating to integrating of Braamhoek Pumped Storage Scheme into the transmission grid, were considered.

##### **5.2.1 The do nothing option (Do not integrate Braamhoek)**

The first option is "do nothing", i.e. do not integrate Braamhoek Pumped Storage Scheme into the grid. This option is rejected because future generation is required to support expected future loads. Braamhoek PSS must therefore be commissioned and integrated into the Transmission grid to achieve this.

##### **5.2.2 Build new transmission lines to integrate Braamhoek**

It is clear that new Transmission lines will be needed for integration of Braamhoek Pumped Storage Scheme. The Transmission lines will be brought into operation at the time when the scheme is commissioned. It is however necessary to secure the necessary servitudes timeously, to ensure this will be possible.

Two technically feasible options for integrating Braamhoek Pumped Storage Scheme have been identified. Refer to Figures 2 and 3 below. As in Option 1, Option 2 (Alternative 10) considered looping in the Majuba Venus 2 400kV line into Braamhoek. Instead of building a 400kV line to Venus, here a line from Braamhoek to Pegasus (75km) is considered. Refer to Figure 2.

The Environmental Impact Assessment (EIA) will be done for both options. Results of the EIA will be used to derive line costs. This will be input into making final, optimized decision on which option is preferred. Servitude acquisition will then be made on the basis of that option.