Attachment 5

Need for Additional 132kV Feeder Bays at Campbell St

The initial regulatory test submission provided 4 feeder bays at Campbell St. These were allocated to providing the following connections

- Campbell St-Beaconsfield- (Beaconsfield-Haymarket Interconnector)
- Campbell St –Haymarket - (Beaconsfield-Haymarket Interconnector)
- Campbell St – Double Bay - (replaced existing connection)
- Campbell St - Surry Hills - - (replaced existing connection)

It was subsequently decided to increase the available connections from Campbell St to:

1. cater for connection of a future CBD zone substation
2. provide an additional 132kV connection to Surry Hills.

Provision of an additional feeder Bay for a future CBD zone

An additional feeder bay was provided at Campbell St to cater for connection of a future CBD zone substation. In 2000 the next CBD zone was to be City West. Whilst cables 92L & 92M run past the City West site, these are unsuitable as supply cables as they lack any spare capacity and are aged (due for replacement by 2015) and suffer from recurring oil leaks.

As there is insufficient capacity to supply any of City West from Lane Cove, the other alternative is to provide supply from Haymarket/Beaconsfield. A total of four circuits are required for the standard CBD substation. It is intended that at least two of these would ultimately (2015) be extended to Dalley St to enable the retirement of 92L & 92M.

Original concepts indicated that City West would be supplied by looping in cables between City South and City Central. Detailed investigations indicated that this is not possible from a rating perspective due to the depth of the Ductline in Kent St. In addition, a double loop-in is prevented by the configuration of Darling Harbour zone substation once this substation is developed to a 3 transformer arrangement.

Given the above it was proposed that two routes each accommodating 2 circuits be used for City West..

a) Down ductline from Haymarket to the vicinity of Pyrmont and then across Darling Harbour and into the 132kV ductline to City West. This route requires clearance of 33kV across Darling Harbour before 132kV can be installed.
b) From Haymarket or Surry Hills along new ducts to Liverpool St and then via City duct line to Clarence St. (It should be noted that there are only 9 ducts in Liverpool St.)

Whilst the cables in route a) would run directly from Haymarket, the cables in route b) could be run from either Haymarket or Surry Hills. Connection from Surry Hills/Campbell St is desired due to:

- Surry Hills/Campbell St are supplied from Beaconsfield, providing increased security of supply for a prolonged outage at Haymarket.

- Congestion around Haymarket would make connections between existing ductline and Haymarket difficult.
- Potential exists to have one connection from the Surry Hill annex, deferring the need for a CB until a 132kV bus is established at Surry Hills STS.

It was decided to provide a spare future 132kV bay at Campbell St as

- There is a need in the medium term (2006-7) for four circuits to City West and in the longer term (2010-3) for a further four circuits to City East. The proposed spare bays at Haymarket cater for two of these circuits plus future circuits to Surry Hills, however there are insufficient spare panels to cater for all connections to future CBD zones.
- It is desirable to have some diversity of sources of supply to the CBD in the long term.
- Extension of a GIS switchboard is generally an uncertain (equipment obsolescence) and costly option (single supplier) making future expansion at Campbell St highly risky
- Cost of the additional bay was small (about $350k)
- Campbell St is well located to serve as a connection point for future CBD zones.
- If all circuits to a future CB zone were to come from Surry Hills, 4 sections of bus would be required as well as 4 feeder CBs. Provision of additional connections from Campbell St has the potential to allow the number of sections of bus at Surry Hills to be reduced from 4 to 3.
- The two initial circuits to City West could not be both supplied from Surry Hills, unless a GIS busbar was established together with interconnections to Haymarket. This work is (not anticipated to be required until about 2010 at an estimated cost of $10m) would need to be substantially advanced. The cost of advancing this work is substantially less than an additional CB.

Provide an additional 132kV connection to Surry Hills

An additional connection was provided between Campbell St and Surry Hill STS to provide for increased security to Surry Hills and Dalley St. By installing this Cb it was also possible to reduce the number of bus-sections and hence circuit breakers at Surry Hills in the long term

Surry Hills STS (270MVA load) and Dalley St zone (180MVA CBD load) are supplied by four oil-filled cables which run from Lane Cove via a Harbour crossing. The cables run in two double circuit trenches for most of their routes, however they share a common submarine crossing of Sydney harbour. This method of installation makes them vulnerable to mechanical damage causing simultaneous outage of two circuits.

These cables were installed in the mid-1960's and are aging. Two of the circuits 92L and 92M have a history of major oil leaks from both joint bays and cables. The length of these cables 15km each, means that they have a much higher outage rate than shorter circuits. Significant portions of their route lies along major traffic routes, resulting in significant access restrictions and long repair times.

Since these cables were installed there has been significant development both along and over the routes of these cables. Two circuits run directly under a major hotel in the Rocks area and can no longer be accessed for repairs. When one circuit failed under the hotel it was necessary

to re-route the failed circuit which resulted in an outage of significant duration. It is likely that a further failure could take many months to repair.

Prior to the establishment of Campbell St, interconnection had been provided from Beaconsfield West to two of the Surry Hills transformers. This interconnection provided an emergency back-up supply to cater for the simultaneous outage of both cables in a trench arising from mechanical damage. There was no provision to cater for the simultaneous outages of the two cable which were not provided with interconnection. Such an outage could potentially require the shedding of up to 120MVA for a period of weeks. Whilst such an outage had not been originally considered as a credible contingency, the recent performance and outage times of the Lane Cove cables meant that such an outage was now considered to be credible.

The interconnection of a third Surry Hills transformer to Beaconsfield provided a backup to cater for the simultaneous loss of any two Lane Cove cables. This work involved an additional feeder bay at Campbell St and installation of about 500m of cable through the proposed tunnel. The cost of this work ($350k GIS bay and $530k feeder) was relatively minor and represents an advancement of work rather than additional work.

In the longer term it is proposed to install a:

1) GIS busbar at Surry Hills (2010); and
2) to replace the Lane Cove Dalley St cables (2015) .

This work would require the connection of all four Surry Hills transformers to the Beaconsfield West/Haymarket system. As ultimate loading on both the Campbell St and the Surry Hills busbars is well above the capacity of a single feeder it is proposed to minimise the need for circuits from Haymarket by establishing a high capacity feeder from Campbell St to Surry Hills. As this interconnector will be formed by reconnecting the Campbell St –Surry Hills 928 feeder, it would leave all four Surry Hills transformers to be supplied from the Surry Hills GIS bar, requiring four sections of bus at the future Surry Hills GIS bus.

Connection of an additional Surry Hills transformer to Campbell St advances the proposed connection but reduces size of the required busbar to three sections.