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Analysis of NECA pricing recommendations

1.0 Introduction

This report examines the impact of the NECA pricing recommendations for the TransGrid transmission network. In particular, it looks at NECA's recommendation to calculate a *customer TUOS usage charge* according to three different methods – CRNP, a modified version of CRNP and LRMC.

2.0 Main Findings

General

1. The preferred pricing method is to use CRNP with a higher degree of averaging within a geographical area in order to eliminate price spikes.
2. The need to develop a price range should be abolished.
3. The requirement to calculate prices in accordance with the modified CRNP method and the 'direct LRMC' method should be reviewed. It may be more appropriate to simply stipulate that alternate methods may be used instead of CRNP without actually stipulating the details of the methods.
4. The need to calculate prices that reflect LRMC should be reviewed given the lack of robustness associated with any pricing method that relies heavily on assumptions about the future.

LRMC

1. The method proposed for the direct calculation of LRMC is actually not an LRMC method. Rather it is a calculation of the incremental costs associated with a forward looking capital program. This approach can often result in enormous prices especially when the capital program only looks five years into the future.
2. TransGrid would not use NECA's suggested method for calculating direct LRMC prices due to the high prices that result.
3. The high degree of arbitrary assumptions associated with LRMC pricing brings into question the intention to use these rates to calculate embedded generator pass through payments. This entire issue needs serious reconsideration. There definitely needs to be greater onus paced on the proponents of embedded generator projects to show that they actually have deferred any upstream transmission system augmentations. It may be better to calculate the benefits, if any, associated with embedded generator projects on a case by case basis.

CRNP

1. The standard CRNP method seems to generate reasonable prices in most situations. The main criticisms relating to higher prices in some remote locations can be overcome by increasing the level of averaging in areas.
2. It is recognised that in some cases CRNP may not produce sensible outcomes. For example, calculating a price for a new 'lumpy' load like a smelter. To overcome these problems it is suggested that a generic clause

be added to the code stipulating that alternate methods may be used without actually stipulating what those methods are.

Modified CRNP

1. There is no direct relationship between utilisation and augmentation costs. This relationship will vary greatly depending on the network topology.
2. Using a single utilisation cost curve for the entire network is inappropriate and over simplifies the analysis
3. The criticism of the basic CRNP method in terms of signalling too high a price in supposedly under-utilised remote areas seems unjustified.
4. There would seem to be little value in this approach given the additional complexity required to produce a robust pricing method, and the fact that the basic CRNP algorithm seems to produce reasonable prices when a higher degree of averaging is used.

3.0 NECA's customer TUOS usage charge proposal

NECA's proposal for calculating a *customer TUOS usage charge* is as follows:

1) A cost range is to be established for each connection point by calculating prices according to three different methods. The three methods are:
   a) CRNP using the normal 50/50 allocation rule
   b) Modified CRNP that takes into consideration utilisation; and
   c) Direct calculation of LRMC
2) A price is then to be selected from the established price range that best reflects future transmission costs.

4.0 Analysis

This section of the report examines the prices that would apply to the TransGrid transmission network if the NECA recommendations are adopted. It mainly focuses on a comparison between CRNP and the direct calculation of LRMC prices.

Incremental Capex versus CRNP

NECA's suggestion for a direct LRMC calculation is based on calculating the cost of capital associated with a planned capital works program and the load growth that the capital works supports. This is actually a measure of the incremental costs associated with a specific capital works program and for this reason I refer to this method from here onwards as the Incremental Capex method. The detailed steps are as follows:

- Determine which loads benefit from each capital works project
- Determine the present value of the annual costs of the particular capital works project
- Determine the present value of the incremental demand for all connection points

- Allocate the present value of the costs of each project to the connection points that benefit on a pro-rata basis using the present value of the incremental demand
- Determine the price at each connection point by dividing the total cost allocated to the connection point by the present value of the incremental demand at the connection point

The above approach was applied to the TransGrid network using the capital works program in our 5 year annual planning statement. The only deviation from the above approach is that present values weren't used. The summation of the costs and loads were used instead of present values. This results in slightly lower prices.

Figure 1 shows a comparison between the Incremental Capex method and the standard CRNP algorithm which allocates 50% of the shared network costs. The results show that the incremental costs are much higher than the CRNP prices especially in those areas with considerable capital investment such as Lismore. The actual average incremental price for the entire network is $40/kW. This is actually higher than our average network price of about $33/kW.

Using the incremental costs of a short term capital program will result in widely varying prices depending on the extent of capital works planned in the period. You may, for example, have 5 years of low capital investment that will result in low incremental prices. On the other hand, you may have a large capital program occurring in the 5 years, as we do in this case, that results in large incremental prices.

The incremental prices themselves will be large for a number of reasons. Firstly, the capital invested in the 5 year period will serve considerable more load growth than that occurring in the five year period. Secondly, you may have areas such as Lismore where the capital works program is not so much load growth related, instead it is needed to provide basic levels of reliability and to improve voltage stability.

The results demonstrate that short term incremental prices can't be used as the basis for determining an LRMC rate. The obvious question is why then don't you simply look at a longer period? The answer to this is that you simply can't predict with any level of accuracy what the likely capital program will be 10 to 20 years in advance. This in itself is the basic problem associated with trying to calculate an LRMC price.

The other major problem with LRMC pricing is the fact that this price is going to be used to calculate the pass through to embedded generators. Given the lack of robustness associated with any pricing methodology that claims it can predict the future, it is questionable as to whether LRMC pricing should be used as the basis for the pass through of potentially millions of dollars to embedded generators. There definitely needs to be considerable more onus placed on the proponents of embedded generator projects to demonstrate that they defer upstream transmission investment. It may also be better to calculate the benefits of such proposals on a case by case basis.

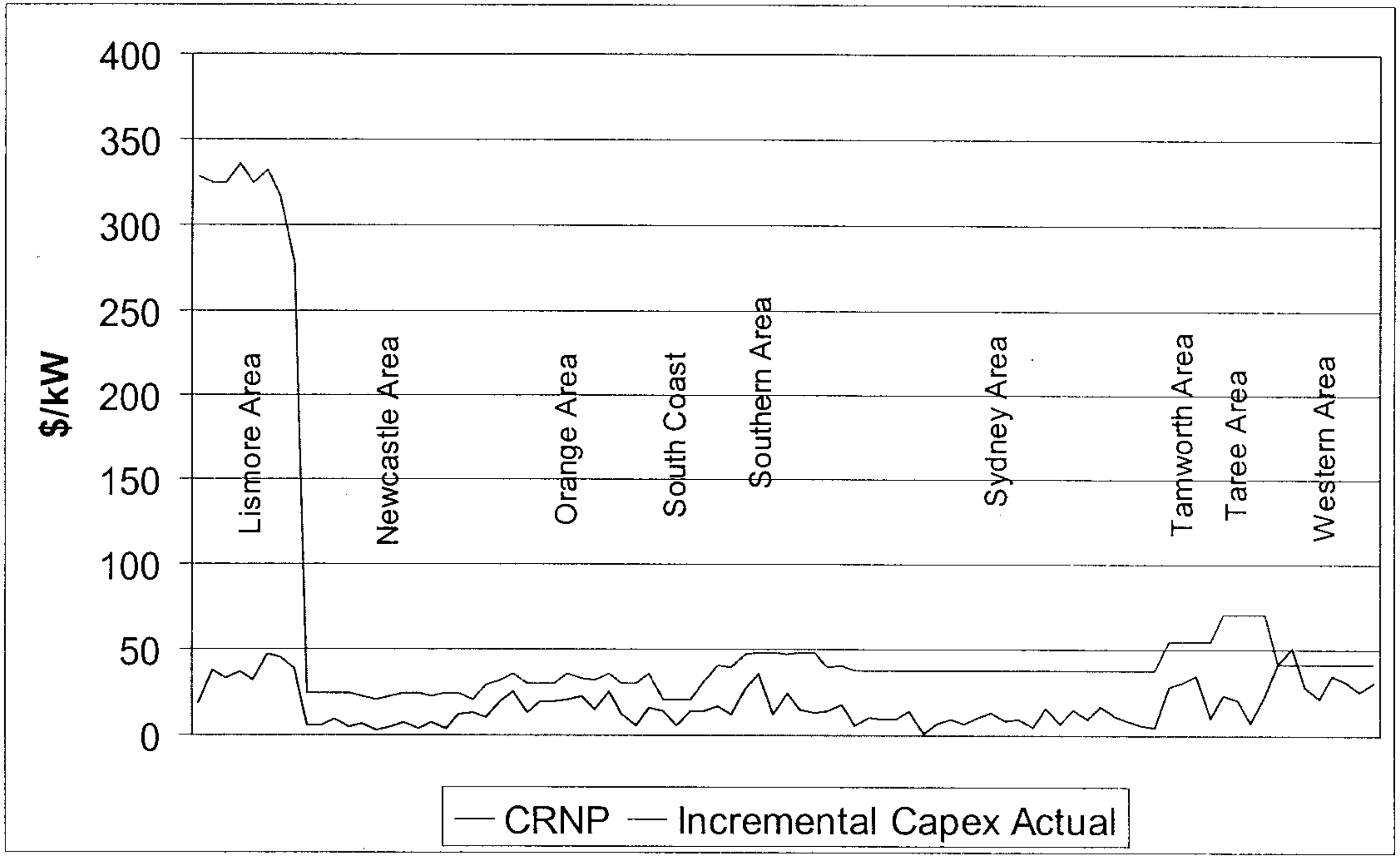
$/kW
400
350
300
250
200
150
100
50
0
Lismore Area
Newcastle Area
Orange Area
South Coast
Southern Area
Sydney Area
Tamworth Area
Taree Area
Western Area
CRNP
Incremental Capex Actual

Figure 1

Normalised Incremental Capex versus CRNP

This section of the report compares the Normalised Incremental Capex prices with the standard CRNP prices. The Normalised Incremental Capex Prices are identical to that in the previous section except that the prices have been scaled down to yield a lower average incremental rate equal to $21/kW. This rate is the long term historical average incremental rate and has been calculated by:

- Building up a capital stock profile going back to 1976
- Calculating the user cost of capital associated with the capital works occurring between 1976 and 1999; and
- Dividing the above figure by the total system load growth occurring between 1976 and 1999.

Without normalisation, the average Incremental Capex rate for TransGrid's 5 year capital program would be $40/kW. This is considered too high and is a reflection of a large amount of investment occurring in a short period of time. This price should reduce significantly if the duration of the capital program being examined was lengthened to say 20 years. Given the problems with looking this far into the future, it was decided to look backwards in time to calculate a long term historical average.

Figure 2 shows a comparison between the normalised capex prices and CRNP. In addition to normalising the prices, the rate for the Lismore area has actually been capped at $40/kW (the actual average incremental rate for NSW). The results are a little hard to compare in that the incremental prices have a higher degree of averaging across geographical areas than the CRNP prices. This in fact highlights what I believe is the main problem with CRNP.

Consider, for example, the large spike in the Western area. This is actually the price for Broken Hill and is one of the reasons why CRNP has been criticised and why the utilisation based form of CRNP has been introduced. It terns out, however, that the spiky nature of the CRNP prices can be overcome quite simply by having a greater degree of averaging across geographical areas. Having a higher degree of averaging is consistent with the meshed nature of the network and the shared benefits that are derived from it.

why then both with cost reflectivity → postage stamp it all seems the suggestion!

Figure 3 shows the results when the CRNP prices are averaged across geographical areas. The high prices that occur at some locations have been totally eliminated producing a significantly more palatable outcome.

Figure 3 shows that the CRNP prices and the normalised incremental capex prices are different, with the incremental prices typically being larger than the CRNP prices. This is to be expected as the incremental prices have been scaled down to achieve a network average of $21/kW whereas the average network rate for the CRNP method is about $12/kW.

The fact that the prices are different highlights a basic problem with the pick a price from the range methodology. What price do you want to pick, the CRNP or normalised incremental price ? The problem with this question is that there is no measure of which price is more appropriate so how do you choose.

The CRNP approach with a greater degree of averaging would seem to be the more attractive method mainly because the Incremental Capex based method is going to produce extremely volatile answers as you recalculate your prices every 5 years. The main reason for this is that large capital works projects that may be present in one 5 year band will disappear in the next 5 year band effectively becoming sunk assets. The CRNP approach is also more robust in that it eliminates the need for making large numbers of rather arbitrary assumptions.

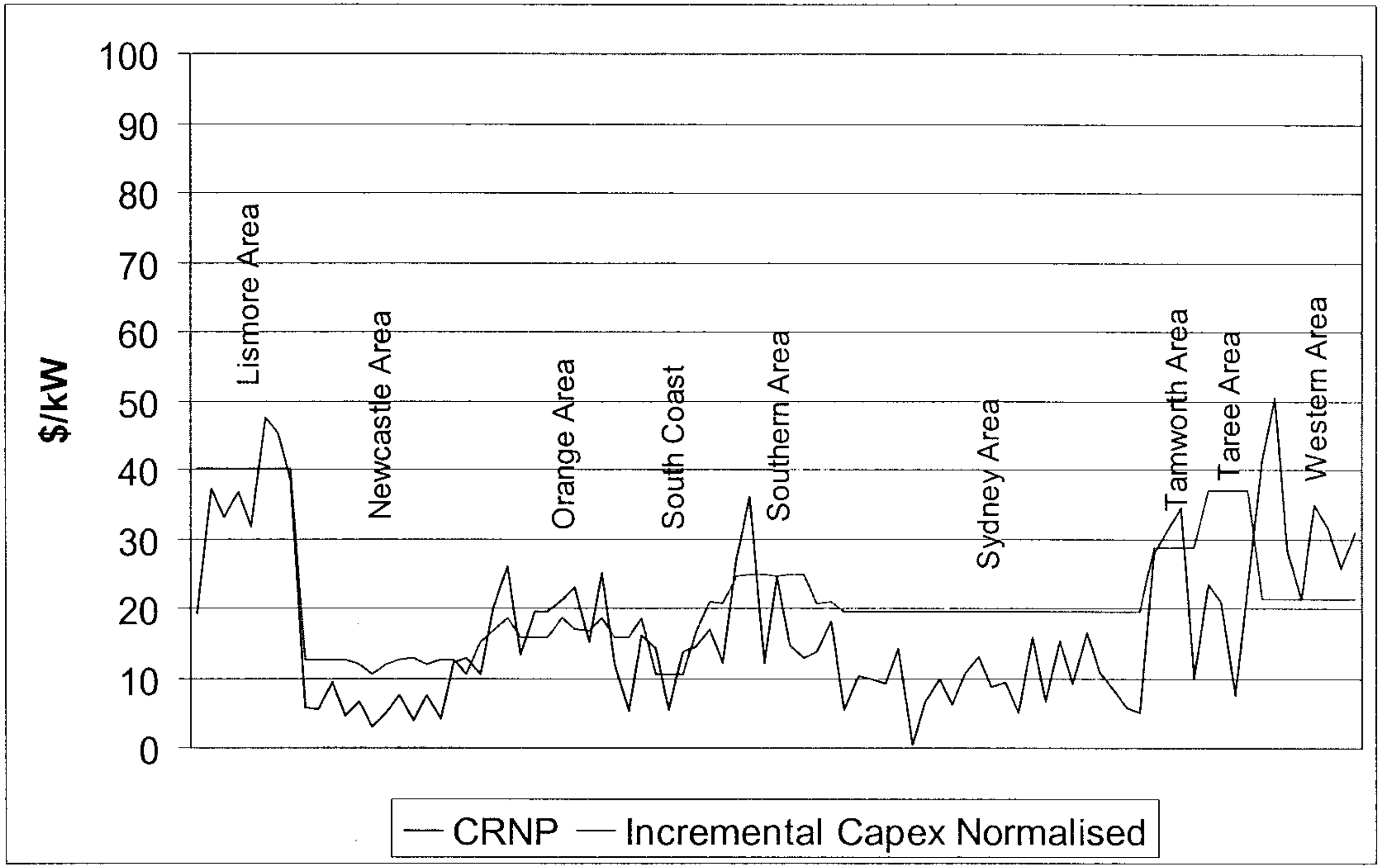

Figure 2

how are the geographical areas determined?

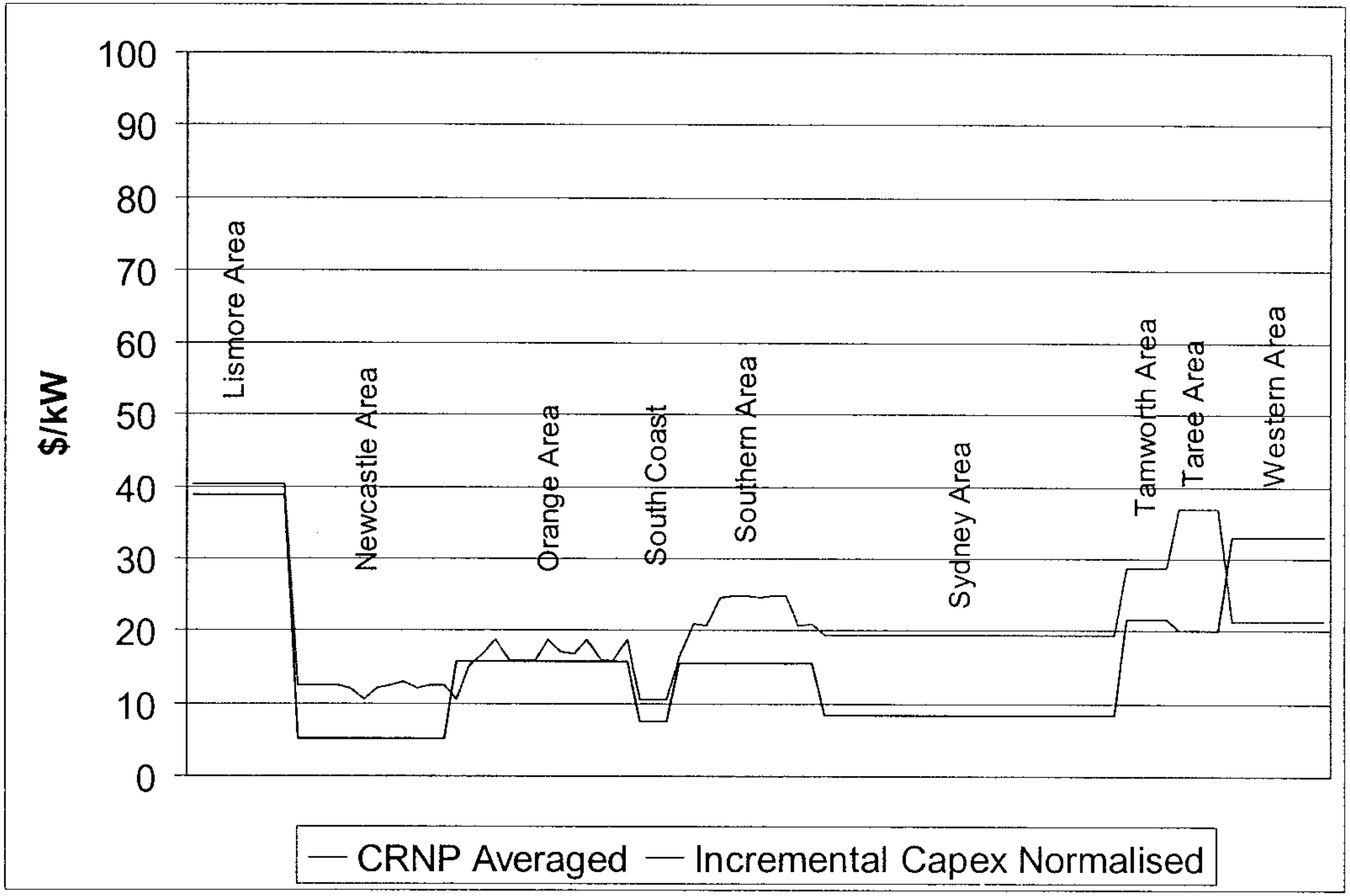
$/kW
100
90
80
70
60
50
40
30
20
10
0
Lismore Area
Newcastle Area
Orange Area
South Coast
Southern Area
Sydney Area
Tamworth Area
Taree Area
Western Area
CRNP Averaged
Incremental Capex Normalised

Figure 3

Comments on the Modified CRNP method

This method is similar to the standard CRNP approach except that you reduce or increase the revenue that you allocate for an asset based on its utilisation. In looking at this method, NECA's consultant used a single cost utilisation curve for the entire Victorian system which had the following properties:

- Any assets with utilisation less than 60% cost set to zero;
- Assets with utilisation between 60% and 80% cost set to 37.5% of existing asset cost; and
- Assets with utilisation greater than 80%, cost set to 75% of asset cost

The basic problem with this approach is that there is no direct relationship between utilisation and augmentation costs. Consider for example Figures 4 and 5. Both figures show simple two bus networks, one consisting of three lines and the other consisting of two lines. Both networks are planned so that the load can still be supplied with the outage of any one transmission line.

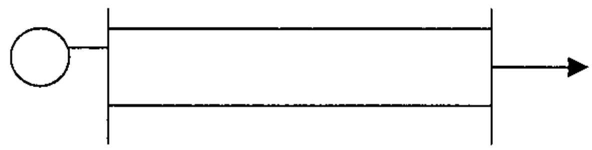

Figure 4. 2 bus network

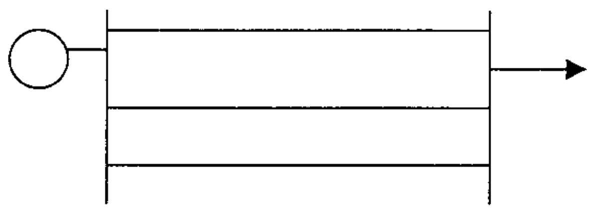

Figure 5. 3 bus network

For the 2 line network, the expected maximum utilisation with both lines in service is 50%. If utilisation is above this figure then the remaining in service line will not be able to supply the load during a single line outage. Therefore, as the utilisation approaches 50%, a third line (or demand side option) should be considered. The augmentation costs of the third line will be equal to half the costs of the existing two lines. The cost utilisation curve characteristics for this case would be:

- As the utilisation approaches 50% allocate 50% of the line costs.

For the three line network, the results are totally different. The maximum utilisation for this network, allowing for a single outage, is 66%. As the utilisation approaches this figure then a fourth line should be considered with augmentation costs equal to 33% of the existing line costs. The cost utilisation curve characteristics for this case would be:

- As the utilisation approaches 66% allocate 33% of the line costs.

This simple example illustrates the basic problem with this method in that the cost utilisation curves are totally dependent on network topology which is extremely complicated given the meshed nature of the transmission network. If this method were to be applied robustly then you would almost need a different cost utilisation curve for every line in the state. This is insanely complex and is hardly warranted given the fact that the problems that this method is trying to overcome can be rectified by simply applying a greater degree of averaging in the standard CRNP approach.

This approach wasn't applied given the complexities associated with developing reasonable cost utilisation curves and the lack of robustness associated with the suggested approach.

5.0 Conclusions

The overriding priority with pricing methods should be robustness. The direct LRMC calculation approach and the modified CRNP method both lack the robustness necessary to be considered for the allocation of hundreds of millions of dollars of network charges to end consumers.

After considering the three different methods, the preferred option would be to use the standard CRNP method with a higher degree of averaging within geographical areas to avoid price spikes. It is recognised that in some cases CRNP may not produce sensible outcomes. For example, calculating a price for a new 'lumpy' load like a smelter. To overcome these problems it is suggested that a generic clause be added to the code stipulating that alternate methods may be used without actually stipulating what those methods are.