

Electricity Commission
Wellington

**Submission on Relative Power Factor Correction Cost
System Studies Group NZ Ltd – Report dated 19 October 2007**

Northpower would like to make the following comments in connection with the report by SSG dated 19 October 2007.

The SSG report basically compares the cost of installing capacitors on the grid versus the cost of installing capacitors on the HV distribution network. The report concludes that, although the cost of installing capacitors on the HV distribution network is higher, there is a greater benefit from installing capacitors on the HV distribution. From an engineering point of view this may be correct; however it is not appropriate to conclude that this is the best place to locate power factor correction if not all the options have been analysed.

Power Factor Correction by End Use Consumer or at Appliance

Traditionally, power factor correction has been applied at the consumers' premises.

In addition, there has been a lot of effort by the Government recently to improve the energy efficiency of appliances. The report does not appear to have considered this option and gives no reason why this was not considered. In regard to the reduction in losses, the closer to the electrical load that the power factor is corrected, the greater the reduction in network losses.

Northpower suggests that it would be most efficient to introduce standards for minimum power factors for appliances and other equipment connected to electricity networks (whether permanently wired or plugged-in), rather than correcting for low power factors by installing large capacitor banks on distribution networks or on the grid. While changing the standard for appliances would not have an immediate effect on the overall power factor, it would lead to a long-term improvement as existing appliances were replaced at end-of-life. Given that the assets of a switched capacitor bank may only have a 15–20 year life, the short term response might be to install capacitors initially on the HV distribution but, eventually, improvements in end-user power factor would cater for both load growth and replacement of most of the HV distribution capacitors as they reach end-of-life.

Economic Evaluation

Northpower considers that the economic evaluation in the report appears to be fundamentally flawed for two reasons.

1. It does not include the maintenance and operating cost of switched capacitor banks, and
2. If the investment is made by the Distributor, there is no way that any benefits from the consequential saving in losses will be returned the Distributor. A fundamental principle of economics is that a financial justification should only include the economic benefits that are returned to those who made the capital investment.

Also, as line charges are capped, there is no way for the Distributor to recover the cost of the investment or any of the operation and maintenance costs. However, there is no reason that Transpower or the Generator/Retailers could not enter into contracts with Distributors to install capacitors on the HV distribution network.

Technical Issues

There are a number of technical issues that do not appear to have not been considered or factored into the evaluation. These include:

- Switching spikes and their consequential impact to consumers.
- Ripple-signal absorption.
- Voltage step-changes when the capacitor banks are switched. (This may have an impact to consumers but also could result in more operations of the OLTC's at the zone substations.
- Reduced reliability as the capacitors and their surge protection are prone to failure. More capacitance will be put in industrial & commercial parts of the network, and these are the very parts of network where network reliability is most important.
- Review of the likely impact of harmonics on the capacitors. As the use of "non-linear" electrical loads (typically electronic devices, such as computers, compact fluorescent lamps, motor drives and general household devices) increases, we can expect to see increased harmonic pollution of the power network.

Application of the Power Factor Requirement

The report lacks detail in a number of areas such as:

- Where will the power factor be measured?
- Over what periods will the requirement for a 0.99 lagging or better power factor apply - at all times, at peak load or some other specific times?
- Is there any consideration of the relative scale of the network? Installing assets to further correct the power factor at a GXP running 10 MW at a power factor of 0.97 at peak would seem a waste of resources. In this case it would make more sense to install an additional 0.8 MVar as part of a larger capacitor bank at a much larger GXP to achieve the same overall improvement on the transmission grid.

Russell Watson
Network Planning Manager

and
Mike Hayes
Network Commercial Manager