Response to submissions

Transpower greatly appreciates the submissions received on the draft Transmission Code and associated commentary.

Responses to the principal issues expressed in the submissions, including comments received from Transpower staff, are provided below.

Issues expressed in more than one submission are addressed collectively, so there is no one-to-one correspondence between the submissions and the responses below.

Lesser issues, e.g. some definitions, and minor errors, etc, have been addressed in the revised draft Code now available, but are not responded to here.

1 Introduction

1.1 Code purpose and audience

Issue: The purpose and audience of the Code are not clearly stated.

Transpower's response: The introduction to the Code has been revised to address this issue.

1.2 Relationship with EGRs

Issue: The Code should define better the process by which it is intended to interact with the existing EGRs (in particular the GRS). It is not clear whether the Code is effectively an extension of the rules and is mandatory or not. That is, can the EC require Transpower to put forward solutions that are GRS compliant but not Code compliant? Or will Transpower insist on, or have the legal right to, put forward only Code compliant solutions?

Transpower's response: The introduction to the Code has been revised to address this issue.

1.3 Relationship with GPGs

Issue: It's unclear how the Code relates to the GPGs.

Transpower's response: The GPGs are guidelines for power system analysis. Applying them may result in multiple, technically-feasible solutions to a particular transmission system problem. The Code then indicates whether these technically-feasible solutions are regarded as GEIP or not. A solution may be technically-feasible, but not GEIP. For example, an SPS may be able to provide a needed level of security, but be so complex (and therefore have a high risk of mal-operation) or have such a high impact on failure to be regarded as unacceptable, that is, not GEIP.

1.4 Updating the Code

Issue: The Code needs a regular review period in order to provide opportunity for industry review following its application. This would help maintain the industry's confidence in decisions based on the Code.

Transpower's response: As stated in the introduction, Transpower intends to update the Code from time to time, with participation from industry, to include:

- Additional technical areas
- Advances in good electrical industry practice
- Further analysis undertaken by Transpower
- Developments in the relative size, duty, age, and technological status of New Zealand's transmission network

These updates will be available through Transpower's website. Transpower's view is that a regular review period might become administratively onerous.

2 SPS

2.1 Applications

Issue: HVDC controls are categorised as Application 1 (robust system design), whereas Transpower's present HVDC runback scheme, and specified new HVDC runback scheme, are intended to maximize power transfer while avoiding transmission reinforcement, which is Application 2.

Transpower's response: The HVDC control system's prime function is to ensure that the HVDC operates correctly, but it has the capacity to provide other types of protection, so can be regarded as either Application 1 or Application 2 (and therefore is subject to the Code).

2.2 Design principles

Issue: The term "sufficient redundancy" needs to be explained or defined. What is sufficient ?

Transpower's response: The term "sufficient redundancy" is consistent with the WECC and NERC standards. While less specific than, say, "fully duplicated", it allows the SPSs to have a robustness that is commensurate with the impact of its failure.

3 Planned outages

3.1 Project work

Issue: We agree that the planned outage criteria should not include a margin for project work. Transpower's planning role is to ensure that sufficient lead time is factored into any proposal to ensure that the proposal can be implemented. The economic cost of bringing forward some transmission options to achieve this may make them uneconomic, and this should be accepted as a consequence of economically efficient transmission planning.

Transpower's response: Transpower notes the agreement on this issue.

3.2 Outage windows

Issue: Some confusion was expressed over this issue and several submitters questioned the basis for the every-weekend and 70% outage windows.

Transpower's response: The two criteria (every weekend and five days for 70% of the year) are based largely on experience and the knowledge that outages for maintenance in some areas are currently very difficult to schedule. This difficulty of scheduling results from:

- Constraints within the system
- Need for system security during maintenance, which encompasses the demand profile and the system's capacity, topology, and design
- Need for multiple outages in some instances
- Need to coordinate with generators and customers
- Difficulties of access
- Weather
- Availabilty of staff.

3.3 Access for planned outages

Issue: We agree that it is critical to grid reliability that Transpower achieves an acceptable level of access to assets for routine/preventative maintenance. Access has to be prearranged and can be just as big an issue as resourcing problems for contractors. There may be a very narrow access window, which if it missed means you may have to wait for a long time to get another.

Transpower's response: Transpower agrees that access is important to maintaining equipment.

3.4 Load forecast

Issue: What load forecast will be used for outage planning and who will produce the load forecast for weekends and every week of the year?

Transpower's response: Transpower will produce the load forecasts, based on average historical loads extrapolated according to the EC's Statement of Opportunities.

3.5 Load management

Issue: What assumptions should be made about load management? Historical data does not include load management and most (perhaps all) distributors have been focussed on winter load management. The current TPM encourages this approach, so how will load management in the off season be encouraged to achieve outages for maintenance?

Transpower's response: Transpower recognises this challenge and will continue to work with the industry to resolve it.

3.6 Design for maintenance

Issue: Comparing the topologies of Auckland and Christchurch with that of London may be unreasonable given the London demand is much larger than the Auckland or Christchurch demands.

Transpower's response: The comparison is not intended to demonstrate the performance of similar demands, but the impact of the general sparsemess of New Zealand's network compared with that of, say, London. Sparse networks require relatively more redundancy to enable outages to be taken.

3.7 System capacity

Issue : We caution that the 'voice of consumers' be heard in the mix during a decision making process. If there are grid exit points that currently have N security and don't meet the Code requirements for outage planning, there may be reasons for the existing levels that need to be considered in determining what, if any, investment should be made. The price/quality trade off issues need to be well explained to consumers in order to help them make informed decisions.

Transpower's response: The Code does not currently apply to connection assets, but may do so in the future.

4 Reactive compensation

4.1 Generic modelling

Issue: The Commentary says "there should be a smooth, progressive decline in voltage as load increases". The controls of dynamic reactive devices may need to be specially modified to behave like this. On the other hand, the Code itself provides the option to monitor the reactive reserves if the voltage characteristic is *not this preferred slope*. So, this section of the Commentary appears to contradict the Code.

Transpower's response: The Commentary is intended to describe the difference between a well-conditioned system and an ill-conditioned system, and not to imply a specific control requirement of reactive compensation. As such, it does not contradict the Code. Obviously, it is desirable that the Code and Commentary should be consistent, but, as the Code states, "The appendices to this Code contain commentary that provides context for the contents of the Code, supporting information, and application guidance. In the event of a conflict between the Code and the appendices, the Code takes precedence."

4.2 Dynamic compensation

Issue: Presumably the term "dynamic compensation" refers to continuously variable reactive support such as thyristor-controlled reactors (TCRs) , static compensators (STATCOMs), and synchronous condensers. What is the status of a lone thyristor-switched capacitor (TSC), without a variable thyristor-switched reactor (TSR), or a fast binary switched capacitor (such as in Greymouth) ?

Transpower's response: The Code is talking about capacitive reactive compensation, as stated in the definitions of compensation factor and dynamic ratio. Therefore TCRs are not included but STATCOMs and synchronous

condensers are. The output value used in calculations is the maximum nominal capacitive reactive output.

Including TSCs or fast binary switched capacitors within dynamic compensation needs to be considered carefully and depends on their ability to respond dynamically in aid of system stability.

4.3 Traffic lights

Issue: The Commentary states that the unacceptable "red" zone is where "The system operates in a stable manner until critical reactive reserves are depleted causing the system to collapse without warning. The system, under stable conditions, cannot be operated down to a voltage of 10% below nominal."

This situation would apply at Haywards where, for high DC transfer, a voltage collapse would occur once the dynamic reactive reserves have reached their limit. Collapse is expected to be arrested by DC control action reducing DC transfer, but below 0.9 pu.

Transpower's response: The system described is highly compensated. The transition from being a well-controlled and predictable response system to an uncontrolled and voltage-unstable system can take place suddenly and at voltages above 0.9 pu. Transpower also has no control over the demand or demand characteristics. This is a prime example of the need to monitor reactive reserves in order to meet the requirements of the Code.

4.4 Importing group – definition

Issue: The curve in Figure 1 could prove very expensive. It means that once compensation exceeds 20% of load at any point on the network a dynamic device has to be installed. This does not reflect GEIP and I don't think this is the intent of the Code. Some account of load group size also needs to be considered in the analysis of reactive compensation requirements.

Transpower's response: An importing group is intended to be an area of a transmission system (e.g. USI, UNI, Zone 16 of the NGT system), rather than a single substation. Figure D.2 codifies the information that we currently have from other utilities on their mixes of static and dynamic compensation. Figure 1 may be adjusted should further information come to hand.

4.5 Acceptable level of reactive compensation

Issue: The real issue here is that the "acceptable levels" are subjective judgements that are unlikely to be accepted by regulators. It would be better to provide guidelines, rather than hard and fast limits. The upper level essentially sets the timing of the next transmission investment, so there will be considerable interest in it.

Transpower's response: Transpower contends that the levels are not subjective, since they are based on analysis of a specific model and, probably more important, on what other utilities do.

If Transpower is going to go beyond what other utilities do (i.e. to extreme levels of compensation), it should proceed cautiously, gaining experience and

resolving any operational problems at each stage, before moving to the next − hence the need to prescribe limits.

This is not to say that the limits cannot be revised, should better information come to hand. The problem with guidelines (as distinct from rules) is that one doesn't have to keep to them.

4.6 Automatic control

Issue: The Code appears to limit any reactive power control scheme to just two sites. This dismisses the idea of a regional scheme, which was being actively promoted in Grid Development. Also, it restricts the HVDC schemes to using only HAY and WIL for reactive devices.

Transpower's response: The thinking behind limiting schemes to just two sites is that wide-area schemes are complex, bespoke, and not to be undertaken lightly without first gaining experience in planning and operating smaller schemes on a particular transmission system. After Transpower has implemented successfully a number of two-site schemes, there is nothing to prevent the Code being revised to allow larger schemes. The old adage "make haste slowly" applies.

4.7 HVDC - compensation factor

Issue: Several members commented that, because of the HVDC, reactive compensation in the Wellington region exceeds the acceptable limit.

Transpower's response: The compensation factor applies to an importing group. The presence of the HVDC means that the Wellington region does not constitute an importing group. (For that reason, also, a VQ analysis is not required.)

4.8 Dynamic ratio - acceptable levels

Issue: It is acknowledged that the curve in Figure 1 is titled "dynamic ratio". However, this curve does not line up very well with the contents of clause 5.2. ie The curve should hit the horizontal axis at 40%. This not correct.

Transpower's response: The compensation factor includes both static and dynamic compensation, therefore having the curve meet the horizontal axis at 20% is acceptable.

Issue: The curve as drawn suggests that a compensation factor of, say, 80% (with a dynamic ratio of zero) would never be acceptable.

Transpower's response: Correct.

5 Other

5.1 Additional sections to the Code

Issue: Several submissions suggested that the Code be extended to cover other technical areas, including substation design, connection assets, and bus security design.

Transpower's response: Transpower intends to expand the Code, from time to time, to include additional technical areas, among other things. To this end, Transpower is grateful to receive such feedback and suggestions as to how the Code might be improved.

5.2 USI security

Issue: The N and N-1 limits are incorrect for the USI, as this would mean that we do not have N-1 right now, which is incorrect. The two limits are the N-1 and N-2 limits I think you might find. This means that the rest of the discussion is actually incorrect and needs to be changed to reflect the N-1 and N-1 during maintenance discussion.

Transpower's response: This will be addressed in the future version of the Code.