Grid Reliability Standards

Presentation to the Security and Reliability Council

Bruce Smith

Agenda

- Deterministic and probabilistic planning standards and how they are applied in New Zealand
  - see handout summarising differences between deterministic and probabilistic standards
  - see handout with Schedule 12.2 – Grid Reliability Standards contained in in the Electricity Industry Participation Code (Code)
- Establishing GRS in the Code
- Process going forward

Deterministic and probabilistic planning standards

- Development of most transmission grids have been determined by applying deterministic standards
- Deterministic standards are based on levels of network redundancy around key assets where a failure of an asset or assets (a contingent event) does not result in a loss of supply
- Deterministic standards are expressed as N-k where k is number of contingent events that a network can manage without loss of supply
- N-1 deterministic standard is applied to the Core Grid covering the loss of a single transmission circuit, a single generator, an HVDC pole, a single bus section, an interconnecting transformer, or a single shunt capacitor
- Core Grid is defined in the Code as a list of transmission assets but generally applying to any transmission assets servicing over 150MW of load

Establishing GRS in the Code

- The GRS came into force on 13 May 2005
- GRS were established after consultation by the Electricity Commission (Commission)
  - It initially pursued an economic approach to grid reliability, strongly linking the GRS with the application of the grid investment test (GIT)
  - It acknowledged stakeholders' concerns about about the uncertainties and implementation issues associated with moving to such an approach.
  - It developed a two-limb grid reliability standard, consisting of an economic standard for the whole grid, underpinned by a "safety net" of an N-1 standard for contingencies on the core grid.

Establishing GRS in the Code (cont'd)

- Therefore, a mixture of deterministic and probabilistic standards has been adopted
- Reviewed by Goran Strbac and Predrag Djapic (Imperial College) in 2008 -

> *"Risk with the deterministic and probabilistic planning approaches In the context of balancing risk and network costs, deterministic standards will always produce a non-optimal solution, i.e. the network will be under or over-invested, depending on particular circumstances. A deterministic standard is likely to lead to over investment, and deliver an increased reliability performance above the optimum in cases of supplying relatively small demand that is located away from generation (with significant network cost). On the other hand, a deterministic standard is likely to lead to underinvestment, and hence lead to an increased level of risk and reduced reliability in cases of relatively larger demand that is located relatively close to generation (modest network costs).*
>
> *It is however important to stress that probabilistic standards provide an opportunity for a range of non-traditional reliability enhancements to be consider and conceptually this should in the long term, lead to an improved network reliability profile."*

Consistency of GRS with operational standards and policies

- It was recognised when developing the GRS that:
  - The frequency, depth and duration of outages on the grid are affected by the how the system is operated in real time
  - The EGRs placed obligations (as the Code still does) on the Commission to have regard to the desirability of Parts C (7 & 8) and Part F (12) operating in an integrated and consistent manner
  - Operational standards and policies are an important aspect of considering GRS
  - If there is a dislocation between planning standards and operational standards, either the planner delivers the operator with an overbuilt grid, or the operator sheds more demand than the planner factored into their economic analysis.

GRS in the Code

- Set out in Schedule 12.2 of the Code
- Change process for the GRS and Core Grid set out in clauses 12.66 to 12.69 of the Code
- Link between investment approval and GRS is set out in the Code. The grid satisfies the GRS if:
  - the power system is reasonably expected to achieve a level of reliability at or above the level that would be achieved if all economic reliability investments are implemented; and
  - with all assets that are reasonably expected to be in service, the power system would remain in a satisfactory state during and following a single credible contingency event occurring on the core grid.
- Economic reliability investments (schedule 12.2) mean investments in the grid and transmission alternatives that would satisfy the economic test; and having regard to Parts 7 and 8 (including the policy statement).

Process going forward

- On the Authority's work plan to review the GRS
- Reconsideration will encompass:
  - A review of the deterministic 'limb' and core grid definition
  - Consistency with:
    - the Commerce Commission proposals for its investment test in accordance with 54S of the Commerce Act (Transpower's capex input methodology)
    - System Operator's operational standards