

12 March 2018

By email: Online forum fyi.org.nz

Official Information request – NZ power grid protection from coronal mass ejection

Dear B Pinkney

Thank you for your request under the Official Information Act 1982 requesting details on what planning and research has been undertaken or commissioned by Transpower relating to grid-related damage from solar activity and grid hardening. We received this request on Monday 12 February 2018.

This response was prepared by one of our Senior Principal Engineers.

Background – Ground Induced Currents

Ground induced currents (GIC) can be due to many reasons, both manmade and naturally occurring. Over the last 50 years Transpower has developed an increasingly sophisticated dense network of ground current recorders that monitor current flows in the neutrals of numerous transformers across the country. These neutral currents are recorded, analysed and stored to help us manage the HVDC and as such we have built up a knowledge base including direct measurements and experience of GIC.

Naturally occurring GIC are mostly associated with the interactions between the solar winds charged particles and the earth's magnetic field, and are visible during auroras. When extremely large and violent solar winds are produced, Coronal Mass Ejections (CME) (GIC large enough to cause damage to power grids) are possible. This is rare, with the most recent event causing wide spread damage and blacking out the province of Quebec in 1989.

Transpower's involvement with research and preparedness for CRM GIC

We receive regular space weather forecasts from the National Oceanic and Atmospheric Administration (NOAA) to our control centres and have operational procedures to manage the effects of GICs ranging from reconfiguration of the network to disconnection and isolation until the GICs reduce below damaging levels.

Transpower utilises the satellite based Global Positioning System (GPS) to provide a nationwide universal time synchronising service. Regarding your question on our reliance on GPS for time syncing in our communications and protection systems, a study has been undertaken to quantify the impact should the GPS constellation be lost for any reason. The

impact of this is expected to be minor with random inconvenient disruptions. The adoption of the 1588 protocol for all switches, routers, and master controllers as part of their normal lifecycle management will completely address the issue by the end of 2025.

Both NASA's Goddard Space Centre and the British Geological and British Antarctic Survey programmes are building computer models of how solar flares, the earth's magnetic field and geology interact so that predictions of the location and magnitude of GIC and their impacts on electricity grids can be made.

Due to our extensive Neutral Current Transducer DC (NCTD) measurement array, its historical dataset, and our power system model, Transpower is involved in a Ministry of Business Innovation & Employment funded international research project to help construct a New Zealand geophysical model. This work will enable us to:

- Predict the likely impact of severe/extreme geomagnetic storms on the New Zealand grid with higher accuracy;
- Inform our real time GIC security policy;
- Test our existing GIC mitigation protocols against historic and predicted GIC to identify improvements; and
- Procure equipment that can accommodate severe GIC or design suitable mitigations to manage such an event.

The project is expected to finish in 2018 with results being available from 2019.

As part of the work done to date in understanding and validating the geophysical GIC, we have also assisted in developing an aurora-warning system for the lower South Island. This was released to the public as part of the MBIE project during the New Zealand Antarctic Science Conference held in Dunedin in 2017

Please do not hesitate to contact me if you have any further questions or comments in relation to this information.

Transpower takes this opportunity to inform you of your right to a review by the Ombudsmen of Transpower's decision regarding the above information, under section 28 of the Official information Act.

Yours sincerely



Hanna Davies
Governance Counsel
Transpower New Zealand Limited