

## Behaviour of Cable Systems Under Large Disturbances – Status Report

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### ABSTRACT

*In the recent past, large disturbances have occurred in many countries. Everybody remembers the Earthquake in Christchurch, New Zealand on 22 February, 2011 when more than 500 cable faults requiring repair were counted. Tsunami events have occurred in Banda Aceh, Indonesia (2004) as well as Fukushima in Japan (March 2011). The resultant tsunami damage was devastating in Indonesia and Thailand as well as the Great Eastern Earthquake in Japan. There have been massive bush fires in Australia that resulted in both cable and overhead line damage. Other large disturbances such as Hurricane Katrina in New Orleans and Super Storm Sandy in New York State have raised many questions that need to be addressed.*

*CIGRE Study Committee B.1 suggested that a team of experts come together and share their respective experiences with the impact of such disasters on cable systems performance. This paper is an update on the findings from earthquakes, bush fires, storms and ice storms in different jurisdictions around the world and shares how these events have affected cable assets.*

### KEYWORDS

Large Disturbances, Seismic performance, Ice storms, Landslides, Global Climate Change, Cable Systems.

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### INTRODUCTION

In the closing session of the CIGRE Auckland Symposium, in September 2013, the General Report outlined the need of further work in this area regarding cable design and/or installation design for seismic areas.

Study Committee members were asked to propose experts from their respective countries, especially if they have experienced such disasters and to assist in the development of a CIGRE Technical Brochure.

The working group Scope of Work was to document the resultant damage, required repairs, recommend improved accessory and cable designs and suggest alternate installation methods for LV, MV, HV and EHV cable systems due to the occurrence of major disturbances.

Major disturbances include the following events:

- Floods, bush fires and global warming,
- Major earthquakes and resultant landslides or tsunamis,
- Hurricanes, cyclones, tornadoes, typhoons,
- Ice storms, windstorms
- Mud and/or landslides.

The current global warming trend is of particular significance because it may very likely be human induced and proceeding at a rate that is unprecedented in the past 1300 years. [1]

Over the past few decades, changes in weather patterns due to climate change or global warming have led to more extreme, frequent, and costly weather events that have included intense rains, ice storms, tornados, floods, hurricanes, heat waves, droughts, and wildfires. These events have caused hundreds of major power outages which have closed schools, shut down businesses, impeded emergency services, and cost the economy hundreds of billions of dollars. In an effort to combat the growing problem, many utilities are developing strategies to modernize and 'harden' their electric grid.

New initiatives are directing substantial investment to improve the grid's efficiency, capacity, reliability, and resiliency. These efforts will not only help make the grid less vulnerable to weather-related outages, they will also help reduce the time it takes to restore power after this number-one cause of outages occurs. [2]

The following is a chronological list of some recent large disturbances around the world and is not a complete list, but representative of recent disturbances.

Volcano Eruption, Hawaii Big Island May 2018

- Papua New Guinea, March 2018
- Taiwan Earthquake, February 2018
- California Fires and Mudslides, January 2018
- Hurricane Ophelia (Oct 9-16 2017)
- Hurricane Nate Costa Rica and Southern USA (Oct 7-10 2017)
- Hurricane Irma (Sep 10 2017)
- Mexico earthquake (Sep 19 and 23 2017)
- Flooding and landslides in Southern Japan (July 2017)
- Hurricane Maria Caribbean and Central America (Sep 23 2017)