IEEE PES Student Chapter, Holcombe Dept. of Electrical & Computer
&
Real-Time Power and Intelligent Systems Laboratory Seminar Series

Power Oscillation Event in New Zealand Power Network on 13 December 2011

September 24, 2012 – 6.30 pm to 7.30 pm, 100A Riggs Hall Clemson University

New Zealand comprises of two islands with relatively small power systems electrically connected together by a HVDC link. The 400km HVDC link serves as a critical link allowing electrical power transfer between the two islands in both directions depending on generation dispatch and load demand. The North Island power system has a peak load demand of about 4500MW and is served by a mix of CCGT, Thermal, Hydro, Geothermal, Wind and Industrial Cogeneration. The South Island power system serves a peak load demand of about 2500MW including a 604MW DC smelter load in the southern part of the power system. 98% of the South Island power system generation is derived from hydro generation.

The New Zealand reserve market is designed to cover, without loss of load, either the loss of the largest generator in the island or the loss of one of the two converting poles on the HVDC link. This single contingent event shall not cause system frequency to dip below 48 Hz. There are two types of spinning reserve that are offered into the market: Fast Instantaneous Reserve (FIR) and Sustained Instantaneous Reserve (SIR). FIR is defined as the increased output produced by a generator after 6 seconds, in response to a standard injected frequency curve. SIR is the average increased output over 60 seconds in response to the same test.

In 13the December 2011, an under frequency event followed by power oscillation was initiated with a contingent event at Huntly Power station. The event commenced with the disconnection of Huntly unit 5 and all the half circuit breakers in Huntly Power Station from the North Island Grid System resulted in the remaining Huntly generating units (Unit 1 & Unit 3) connected to Grid System via two of the 220/33kV supply transformers. Subsequently, Huntly unit 1 and Unit 3 tripped from Huntly Station protection. The disconnection of Huntly generation from the grid caused North Island system frequency to drop to 47.65Hz resulting in loads being shed through Interruptible Load (IL) shedding scheme and the Automatic Under-Frequency Load Shedding (AUFLS) scheme before frequency recovered to 50.2Hz. North Island Power System observed voltage magnitude,

angle, frequency and power oscillation during the period of system under frequency. Frequency oscillation related to transient instability phenomenon is recorded around Auckland area with oscillation frequency varied from 4Hz to 6 Hz.

Transpower as New Zealand System Operator has the responsibility to ensure that New Zealand Power System operates within the stability boundary under all system conditions. As a result of this drive, Transpower has installed Psymetrix PhasorPoint and other fast recording devices in both islands to monitor transient events. The presentation discusses the event and the analysis using recorded data.

Nyuk-Min Vong graduated from University of Brighton, UK (previously Brighton Polytechnic) with BEng (Electronic and Electrical Engineering) and Ph.D degree in 1988 and 1992 respectively. He is member of Institute of Electrical and Electronic Engineering (IEEE).

Nyuk-Min Vong is currently employed by Transpower New Zealand Ltd. as Senior Investigation Engineer since December 2006 providing specialist analytic support to power system operations and assessing asset compliance with the Electricity Governance Rules. Prior to his present appointment, he worked with Sarawak Electricity Supply Corporation (SESCo) in Malaysia for 10 years. He has been involved in load flow and dynamic studies, generator testing, dynamic model validation, grid planning and power system operation.