

REPORT

To: MEDOW

From: Mohammad Meraj Alam

Subject: Lecture By Johan Rimez

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On the second day of our MEDOW winter meeting 2015, many presentations were given by participants. A presentation related to power system in conjunction with VSC-HVDC was also given by Johan Rimez who works for Elia Operator, Belgium. The presentation was mainly focused upon impact of VSC-HVDC connection on power system performance.

At present, several VSC-HVDC projects are going on around the world like Inelfe (France and Spain, $\pm 320kV$, 2000 MW), Dolwin1 (Germany and Heede, $\pm 320kV$, 800 MW), Helwin1 (Germany and Buttel, $\pm 250kV$, 576 MW), Sylwin1 and many more. The VSCs are going to be integrated with existing grids. Therefore, it is very important to analyze and estimate the impact of VSC upon power system. As we know that strength of grid depends upon short circuit MVA level of grid and active power injection:

- $SCMVA > 10 * P_{inj}$, then the grid is strong and there is no effect of N-1 as well as N-2 contingency
- $SCMVA = 5 * P_{inj}$, then the grid is neither strong nor weak and it can be stable during N-1 contingency
- $SCMVA < 2 * P_{inj}$, then the grid is too weak and it can't be stable during any fault

The connection of VSC-HVDC in fact reduces Short Circuit Ratio (SCR) of power system as they are very far away from the load centres and long transmission lines are required to carry bulk amount of power. The possible impact of VSC-HVDC upon power system are, for instance,

1. Harmonic impact - A VSC consists of semiconductor devices which continuously switch ON/OFF at a very high frequency. This switching behavior of VSC introduces switching harmonics as well as other lower order harmonics into power system. The harmonics reduce power quality as well as introduce some device malfunction like interference with communication channels required for protection, effect upon digital protection system etc.
2. Protection equipment - AC protection devices, for instance, distance protection, current differential protection etc. installed upon transmission lines are also affected by the presence of VSC-HVDC which can lead to device malfunction and may refrain from fault identification.

Thus knowledge of VSC-HVDC impact is essential from the point of view of continuous expansion of power system and proper adjustment in all the power system components in order to accommodate VSC.