

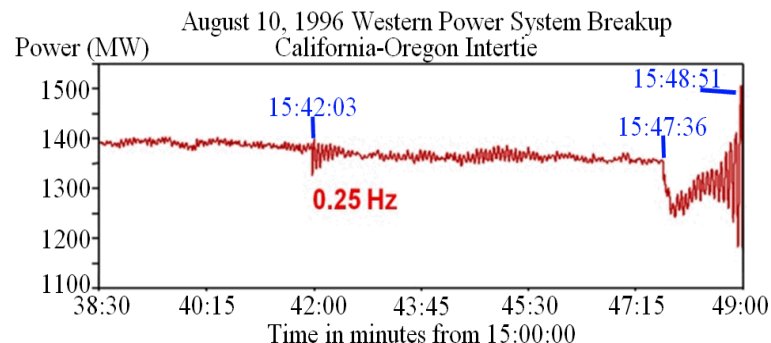
The Benefits of Energy Storage Combined with HVDC Transmission Power Modulation for Mitigating Inter-Area Oscillations

Jason Neely, Ryan Elliott, Ray Byrne, Dave Schoenwald -- Sandia National Labs

Dan Trudnowski, Matt Donnelly -- Montana Tech University

Background:

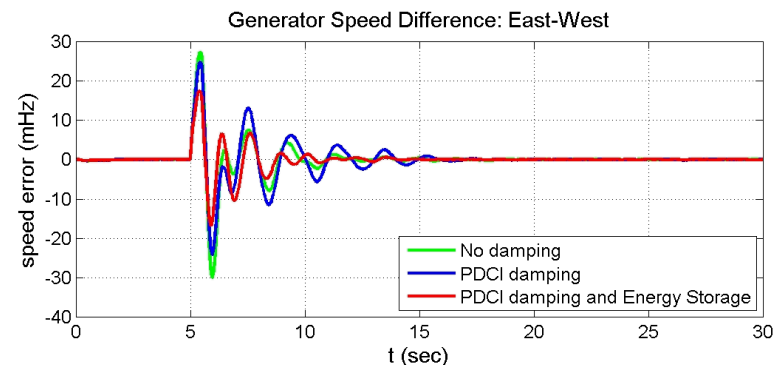
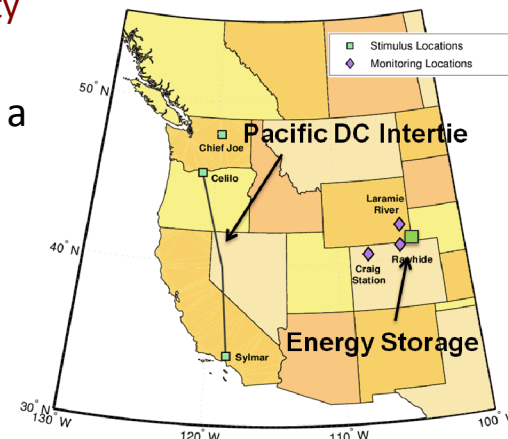
Low frequency oscillations caused by generators separated by long transmission lines, if not properly damped, can cause a system breakup:



Two-area damping implementations have been investigated using energy storage or High Voltage DC transmission

Multi-Area Damping:

Energy storage allows for a multi-area damping implementation, which improves damping of multiple mode shapes



We gratefully acknowledge the support of: Dr. Imre Gyuk, DOE Energy Storage Program; Dr. Phil Overholt, DOE Transmission Reliability Program; BPA Technology Innovation Program (Dr. Dmitry Kosterev, POC)