Detailed Power Stability Studies of the Vietnamese Transmission Grid

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How to deal with future stability challenges in a rapidly growing power system

In December 2016 Siemens PTI presented the final results of a nearly 2½ year detailed stability study of the Vietnamese transmission system to the National Load Dispatch Center of Electricity Viet Nam (EVNNLDC).

The Vietnamese power system is experiencing rapid growth: during the last five years, the total power production has risen by 11.2% per year to 164.312 billion kWh in 2015. To enable the system operator to deal with the consequent stability challenges in the future, the National Load Dispatch Center of Electricity Viet Nam (EVNNLDC) and five expert consultants from Siemens PTI, supported by the local consultant Sai Gon Ban Bai, investigated the stability of the 500/220 kV power transmission system. From August 2014 until project closing in December of 2016, the team worked closely together to identify suitable mitigation measures in order to sustainably improve the stability and reliability of the Vietnamese power system.

Figure 1

The transmission system is built around a longitudinal system with more power generation in the North and load centers in the South of Viet Nam. It is interconnected to neighboring systems such as Cambodia, Lao and China.
Prior to the stability analyses the team engaged in a detailed data collection, refinement and verification. This included several field measurements at selected power plants and substations which were conducted by EVNNLDC, the local consultant and Siemens PTI experts. On the basis of the resulting comprehensive and verified data set, the complete transmission grid was accurately modeled in PSS®E power transmission system planning software using standard PSS®E models or user-defined models, as required. This detailed dynamic system model enabled the team to conduct the analyses for the defined study cases 2015, 2018 and 2020. The main aspects which were investigated include rotor angle stability, voltage recovery, frequency response, transient stability, transfer capability analyses and Eigenvalue analyses.

The results of the stability analyses showed that possible stability risks for the Vietnamese system arise from faults on the transfer from North to South, including the Vietnam - Cambodian power system connection. The studies revealed that strengthening the transfer capability by new 500 kV lines or HVDC connection as well as balancing the generation across Vietnam could improve the system’s stability and reliability. Other recommended measures to enhance the dynamic stability include wide-area load shedding, power system stabilizer tuning, correct SVC placement and increasing primary reserve.

During the project several workshops were held to train the EVNNLDC staff. The sessions covered theory of power system dynamics and stability, hands-on training in PSS®E software, the utilization of dynamic models as well as application of modern technologies, such as SVC Plus, HVDC Plus and other FACTS elements. In the course of these training events, EVNNLDC experts developed a precise understanding of the dynamic phenomena in their own network and how they can take full advantage of power system simulation software to analyze stability related aspects in the power system and make well-founded planning decisions. Mr. Ninh, Vice Director of EVNNLDC, wrote about the project results:

“Firstly I would like to thank you for your kind cooperation and support so far for the project ‘Evaluation, Analysis and Propose Solution for Enhancing the Stability and Reliability of the Vietnamese Power System’.

We have recently reviewed the 2018-2020 stability calculation report and countermeasure report for the year of 2020. We do very much appreciate your efforts to submit on time and also a good quality of those reports.”

Reference