Abstract
Due to the higher demand for transmission service, utility companies are making maximum use of existing facilities. System reliability, which was traditionally considered within the planning activities, i.e., adding more substations and transmission lines, is now incorporated into the operational management environment. There are many issues to address system reliability. The primary problem is typically the heavily loaded transmission lines since it is often the cause of system instability. Congestion occurs when the transmission network is unable to accommodate all of the desired transmissions due to a violation in system operating policies and planning standards. In recent smart grid initiatives, advanced technologies, including information technologies, software programs, advanced equipment and reliability analysis tools are being developed to support grid reliability and efficient market. Among the remedial actions, the use of demand side management (DSM) and distributed energy resources (DER) including distributed generation and energy storage system can offer several benefits. Properly planned and operated DSM and DER could increase system reliability, reduce system losses, relief network congestion and CO_2 emission. However, the interactions between distributed generation and the distribution system in which it is embedded involve several phenomena that require careful investigation. The impacts on the distribution system voltage profile and quality are the major problems that have to be examined. As the amount of DG integration increases the system stability problem become essential. This project aims at studying the existing transmission congestion problem in the metropolitan area of Taiwan and seeking mitigations at the demand side by using distributed generation, battery energy storage system and demand response program.

Keywords: Network congestion, customer participation, distributed energy resources, demand response, system stability, network reliability, power quality, cost-benefit analyses