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## Energy storage control and capacity allocation for improving the stability of power grids

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Power systems around the world have been undergoing profound changes due to transition towards low-carbon electricity supply. As a result, renewable energy sources such as wind and solar have increasingly been deployed in the generation mix displacing traditional synchronous generators. However, these renewable energy sources are inflexible and intermittent in nature—their power outputs cannot be predicted with exactitude or adjusted—and could jeopardize the stability of the power system at high penetration levels. Energy storage (ES) is a flexible resource that can act as a load as well as a generation and can be used to mitigate these problems to maintain a stable and secure power system. Our research investigates the methods of controlling a grid-scale ES for improving the stability of power systems, particularly maintaining the system frequency—a reliable indicator of active power balance in the system—within stable limits. We proposed a distributed controller for ES that can absorb sudden frequency transients to prevent any unnecessary load shedding in the system. We also developed an optimization model that can estimate the size of ES required for this purpose. Furthermore, the unused capacity of ES is utilized to provide another grid service, known as frequency regulation—a centralized control mechanism used for compensating active power imbalances in the system. Moreover, we developed another optimization model for allocating ES capacities for both services. The proposed control and allocation methods are evaluated using the two-area IEEE reliability test system. The results prove that the proposed control and capacity allocation methods are effective in preventing unnecessary load shedding as well as for performing frequency regulation, improving the stability of the power system.

### Biography

Shutha Pulendran is currently a doctoral candidate in the Department of Electrical and Computer Engineering, University of Toronto, Canada. She obtained her Master's degree from Queen's University, Canada and Bachelor's from University of Peradeniya, Sri Lanka, all in electrical engineering. Prior to joining University of Toronto, she worked at General Electric Canada as a research engineer. Her research interests include power system stability and control, renewable resource integration, and energy storage.

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